TENTATIVE

MEK- 8222J
MEK- 8222K

AUTOMATED HEMATOLOGY ANALYZER

MEK-8222

0634-001851A

Model: MEK-8222J/K
Manual code no.: 0634-001851A

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This manual is organized.	1	2	3	4	5
I can find the information I want.	1	2	3	4	5
The information is accurate.	1	2	3	4	5
I can understand the instructions.	1	2	3	4	5
The illustrations are appropriate and helpful.	1	2	3	4	5
The manual length is appropriate.	1	2	3	4	5

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EMC RELATED CAUTION

This equipment and/or system complies with the International Standard EN61326-1 for electromagnetic compatibility for medical electrical equipment and/or system. However, an electromagnetic environment that exceeds the limits or levels stipulated in the EN61326-1, can cause harmful interference to the equipment and/or system or cause the equipment and/or system to fail to perform its intended function or degrade its intended performance. Therefore, during the operation of the equipment and/or system, if there is any undesired deviation from its intended operational performance, you must avoid, identify and resolve the adverse electromagnetic effect before continuing to use the equipment and/or system.

The following describes some common interference sources and remedial actions:

1. **Strong electromagnetic interference from a nearby emitter source such as an authorized radio station or cellular phone:**
   Install the equipment and/or system at another location if it is interfered with by an emitter source such as an authorized radio station. Keep the emitter source such as cellular phone away from the equipment and/or system.

2. **Radio-frequency interference from other equipment through the AC power supply of the equipment and/or system:**
   Identify the cause of this interference and if possible remove this interference source. If this is not possible, use a different power supply.

3. **Effect of direct or indirect electrostatic discharge:**
   Make sure all users and patients in contact with the equipment and/or system are free from direct or indirect electrostatic energy before using it. A humid room can help lessen this problem.

4. **Electromagnetic interference with any radio wave receiver such as radio or television:**
   If the equipment and/or system interferes with any radio wave receiver, locate the equipment and/or system as far as possible from the radio wave receiver.

If the above suggested remedial actions do not solve the problem, consult your Nihon Kohden Corporation subsidiary or distributor for additional suggestions.

The CE mark is a protected conformity mark of the European Community. The products herewith comply with the requirements of the IVD Directive 98/79/EEC.

This equipment complies with International Standard EN55011 (1999) Group 1, Class B. Class B EQUIPMENT is equipment suitable for use in domestic establishments and in establishments directly connected to a low voltage power supply network which supplies buildings used for domestic purposes.

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Conventions Used in this Manual and Instrument

Warnings, Cautions and Notes

Warnings, cautions and notes are used in this manual to alert or signal the reader to specific information.

WARNING

A warning alerts the user to the possible injury or death associated with the use or misuse of the instrument.

CAUTION

A caution alerts the user to possible injury or problems with the instrument associated with its use or misuse such as instrument malfunction, instrument failure, damage to the instrument, or damage to other property.

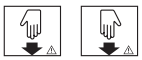
NOTE

A note provides specific information, in the form of recommendations, prerequirements, alternative methods or supplemental information.

Explanations of the Symbols in this Manual and Instrument

The following symbols found in this manual/instrument bear the respective descriptions as given.

On panel

Symbol	Description	Symbol	Description
	Main power lamp		HEMOLYNAC•3 (hemolysing reagent)
	“On” only for part of the equipment		HEMOLYNAC•5 (hemolysing reagent)
	“Off” only for part of the equipment		WASTE
	Laser ON		Hand positions for carrying the instrument
	Reset		RS-232C socket
	Manual		USB socket
	Clean		IVD conformity
	Eject		Fuse
	Start		AC power off (Disconnection from the mains)
	Emergency		AC power on (Connection to the mains)
	Do not touch the sample rack during measurement		Alternating current
	Inlet		Equipotential terminal
	Outlet		Year of manufacture
	Attention, consult operator's manual		Serial number
	ISOTONAC•3 (diluent)		The CE mark is a protected conformity mark of the European Community. The products herewith comply with the requirements of the IVD Directive 98/79/EEC.
	CLEANAC (detergent)		
	CLEANAC•3 (detergent)		

On screen and recorded data

Symbol	Description	Symbol	Description
?	Beside WBC or RBC measured value: Sample error Beside HGB measured value: Dirty measurement baths	*	Beside HGB measured value: HGB circuit error
!	Beside WBC measured value: Poor hemolyzation Beside HGB measured value: HGB voltage adjustment error	C	Beside WBC or PLT measured value: Platelet coagulation

Section 1 General

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Introduction

CAUTION

To maintain the instrument in normal condition, the user must perform the periodic maintenance. Refer to "Maintenance" of the operator's manual.

This tentative service manual consists of the "General" and "Socket Pin Assignment" sections only.

NOTE

If the instrument has a problem and there has been no periodic maintenance, the instrument will usually be normal again by cleaning the fluid paths or replacing a consumable with a new one.

Service Policy

CAUTION

- **Be careful not to directly touch any place where blood is or may spread to.**
- **Wear rubber gloves to protect yourself from infection before doing maintenance.**

Nihon Kohden Corporation's basic policy for technical service is to replace faulty units, printed circuit boards or parts. We do not support component-level repair of boards and units outside the factory.

NOTE

- **When ordering parts or accessories from your nearest Nihon Kohden Corporation's distributor, please quote the NK code number and part name which is listed in this service manual, and the name or model of the unit in which the required part is located. This will help us to promptly attend to your needs.**
- **Always use parts and accessories recommended or supplied by Nihon Kohden Corporation to assure maximum performance from your instrument.**

Specifications

Measured Parameters, Ranges and Reproducibility to Specimen from Venous Blood

Specifications were determined using hematology control blood (MEK-3DN), counted 10 times consecutively.

Measured Parameters	Measuring Range	Reproducibility to Specimen from Venous Blood (CV: Coefficient of Variation)
WBC: White blood cell count	0 to 300 × 10^3/μL	within 2.0%CV (4.0 to 9.0 × 10^3/μL)
NE%: Neutrophil percent	0 to 99.9%	within 5.0%CV (WBC: 4.0 to 9.0 × 10^3/μL, NE%: 40 to 70%)
LY%: Lymphocyte percent	0 to 99.9%	within 5.0%CV (WBC: 4.0 to 9.0 × 10^3/μL, LY%: 20 to 45%)
MO%: Monocyte percent	0 to 99.9%	within 12.0%CV (WBC: 4.0 to 9.0 × 10^3/μL, MO%: 2 to 10%)
EO%: Eosinophil percent	0 to 99.9%	within 20.0%CV (WBC: 4.0 to 9.0 × 10^3/μL, EO%: 2 to 10%)
BA%: Basophil percent	0 to 99.9%	within CV30.0% (>2%) or average value ±1% (0 to 2%) (WBC: 4.0 to 9.0 × 10^3/μL, BA%: 0 to 3%)
NE: Neutrophil count	0 to 99.9 × 10^3/μL	
LY: Lymphocyte count	0 to 99.9 × 10^3/μL	
MO: Monocyte count	0 to 99.9 × 10^3/μL	
EO: Eosinophil count	0 to 99.9 × 10^3/μL	
BA: Basophil count	0 to 99.9 × 10^3/μL	
RBC: Red blood cell count	0 to 14.9 × 10^6/μL	within 1.5%CV (5.0 × 10^6/μL)
HGB: Hemoglobin concentration	0 to 29.9 g/dL	within 1.5%CV (16 g/dL)
HCT: Hematocrit	0 to 99.9%	
MCV: Mean cell volume	20 to 199 fL	within 1.0%CV (70 to 120 fL)
MCH: Mean cell hemoglobin	10 to 50 pg	
MCHC: Mean cell hemoglobin concentration	10 to 50 g/dL	
RDW: Red blood cell distribution width	0 to 50%	
PLT: Platelet count	0 to 1490 × 10^3/μL	within 4.0%CV (3.0 × 10^3/μL)
PCT: Platelet crit	0 to 2.9%	
MPV: Mean platelet volume	0 to 20.0 fL	
PDW: Platelet distribution width	0 to 50%	

Detection Method

Blood cell count: Electrical resistance detection
Hemoglobin: Cyanmethemoglobin optical detection
Hematocrit: Histogram calculation
WBC population: Light scatter by laser
Platelet crit: Histogram calculation
RBC distribution width: Histogram calculation
Platelet distribution width: Histogram calculation

Standardization Analysis Method

WBC: ICSH1988 ICSH: The assignment of values to fresh blood used for calibrating automated blood cell counters. Clin Lab Haematol, 10:203-212, 1988

RBC: ICSH1988 ICSH: The assignment of values to fresh blood used for calibrating automated blood cell counters. Clin Lab Haematol, 10:203-212, 1988

HGB: NCCLS H15-A2 H15-A2: Reference and Selected Procedures for the Quantitative Determination of Hemoglobin in Blood Second Edition; Approved Standard (1994)

HCT: NCCLS H7-A2 H7-A2: Procedure for Determining Packed Cell Volume by the Microhematocrit Method Second Edition; Approved Standard (1993)

PLT: Brecher & Cronkite

Interference Substances

WBC: **Unlysed red cells**

In some rare occasions, the RBC in the blood sample may not completely lyse and these non-lysed RBC may be detected as WBC and cause increase in WBC count.

Multiple myeloma

The precipitation of proteins in multiple myeloma patients may increase the WBC count.

Leukemia

WBC is fragile in leukemia patient and WBC may be destroyed during measurement. These WBC fragments may also interfere with WBC differential measurement.

Chemotherapy

Cytotoxic and immunosuppressive drugs cause low WBC count.

Cryoglobulins

Cryoglobulin may be increased in patients who are or have myeloma, cancer, leukemia, macroglobulinemia, lymphoproliferative disorders, metastatic tumors, autoimmune disorders, infections, anerurism, pregnant, thromboembolic phenomena, diabetes, etc, which cause increase in WBC, RBC or PLT counts and HGB concentration. In such cases, warm the blood sample to 37°C in a water bath for 30 minutes and measure the sample immediately.

RBC: **Leukemia**

An increase in WBC in leukemia patient causes increase in RBC.

Agglutinated RBC

Agglutinated RBC may decrease RBC count. This can be checked by abnormal MCH and MCHC values and examination of the stained blood film.

Cold agglutinins

IgM immunoglobulins which are elevated in clod agglutinin disease may decrease RBC and PLT counts and increase MCV.

HGB: **Turbidity of the blood sample**

Any physiologic and/or therapeutic factors may increase HGB. In such a case, determine the cause of turbidity and follow the appropriate method below.

1. Increased WBC
   An extreme increase in WBC will cause excessive light scatter. In these cases, measure manually. Centrifuge the diluted sample and measure the supernatant fluid with a spectrophotometer.
2. Increased lipids
   The blood sample may be milky when there is excessive lipid. This may occur with hyperlipidemia, hyperproteinemia and hyperbilirubinemia. Accurate HGB measurement can be achieved by manual methods and a plasma blank.
3. Increased turbidity
   When RBC are resistant to lysing, turbidity may increase causing increase in HGB. Observe if MCH and MCHC values are abnormal. HGB result affects MCH and MCHC result.
4. Fetal bloods
   The mixing of fetal and maternal blood may increase HGB value.

HCT: **Agglutinated RBC**

RBC agglutination may cause erroneous HCT and MCV values. Observe if MCH and MCHC values are abnormal. In such a case, measure manually.

MCV: **Agglutinated RBC**

RBC agglutination may cause erroneous HCT and MCV values. Observe if MCH and MCHC values are abnormal. In such a case, measure manually.

Excessive number of large PLT

Excessive number of large PLT and/or excessively high WBC may affect the MCV value. Check by careful examination of the stained blood film.

MCH: MCH is determined from HGB and RBC values. Therefore, the limitations for HGB and RBC also affect MCH value.

MCHC: MCHC is determined from HGB and HCT values. Therefore, the limitations for HGB and HCT also affect MCHC value.

RDW: RDW is determined from RBC value. Therefore, the limitations for RBC also affect RDW value.

Agglutinated RBC

Agglutinated RBC may decrease RBC count and erroneous RDW. This can be checked by abnormal MCH and MCHC values and examination of the stained blood film.

Nutritional deficiency or blood transfusion

Iron and/or cobalamin and/or folate deficiency may increase RDW.

PLT: **Very small fragments**

Very small RBC, RBC fragments and WBC fragments may be the cause in increased PLT count.

Agglutinated RBC

PLT may be trapped in the agglutinated RBC resulting in decrease in PLT. This can be checked by abnormal MCH and MCHC values and examination of the stained blood film.

Very large PLT

Large PLT may exceed the PLT threshold and may not be counted which results in low PLT count.

Chemotherapy

Cytotoxic and immunosuppressive drugs may increase the fragility of cells which may cause low PLT count. In such a case, measure manually.

Hemolysis

Hemolyzed specimens contain red cell stroma which may increase PLT count.

Anticoagulated blood

Blood anticoagulated with acid-citrate-dextrose may have clumped PLT which may cause decrease in PLT count.

Agglutinated PLT

Clumped PLT may decrease PLT count and/or increase WBC count. For such sample, collect the sample in sodium citrate anticoagulant and measure only PLT. The PLT result must be corrected for the sodium citrate dilution effect.

MPV: **Very large PLT**

Large PLT may exceed the PLT threshold and not be counted which results in low MPV.

Very small fragments

Very small RBC, RBC fragments and WBC fragments may interfere with MPV measurement.

Agglutinated RBC

PLT may be trapped in the agglutinated RBC resulting erroneous MPV. This can be checked by abnormal MCH and MCHC values and examination of the stained blood film.

Chemotherapy

Cytotoxic and immunosuppressive drugs may affect MPV. In such a case, measure manually.

NOTE

Blood samples collected in EDTA does not maintain stable MPV because platelets swell depending on the interval after collection and storage temperature.

WBC 5 part differential parameters are derived from the WBC count, therefore, the limitations for WBC also affect these parameters.

LY and LY%: Erythroblasts, certain parasites and RBC that are resistant to lysis may interfere with an accurate LY count.

MO and MO%: Large lymphocytes, atypical lymphocytes, blasts and excessive number of basophils may interfere with an accurate MO count.

NE and NE%: Excessive eosinophils, metamyelocytes, myelocytes, promyelocytes, blasts and plasma cells may interfere with an accurate NE count and NE%.

EO and EO%: Abnormal granules may interfere with an accurate EO count.

BA and BA%: Immature cell, metamyelocytes, myelocytes, promyelocytes, blasts and plasma cells may interfere with an accurate BA count and BA%.

Dilution Ratio

- Venous blood

Sample volume:	55 µL
WBC/HGB:	200:1
RBC/PLT:	40,000:1

- Capillary blood

Sample volume:	10 µL	20 µL
WBC/HGB:	1200:1	600:1
RBC/PLT:	240,000:1	120,000:1

Counting Time

Approximately 45 s/sample, 80 samples/hr

Display

Display:	8.4 inch, TFT type color LCD with touch screen keys
Resolution:	800 × 600 dots
Screen size:	approx. 170.4 × 127.8 mm
Display contents:	Numerical data, scattergrams, histograms, measuring conditions, alarm message and other messages, touch screen keys

Data Storage

Numerical data for all counted parameters for up to 400 samples and histograms and scattergrams for up to 60 samples

Environmental Conditions

Storage temperature:	–20 to 60°C
Operating temperature:	15 to 30°C
Storage humidity:	10 to 95% (Non-condensing)
Operating humidity:	30 to 85% (Non-condensing)
Storage atmospheric pressure:	70 to 106 kPa
Operating atmospheric pressure:	70 to 106 kPa

Power Requirements

Power requirements:	MEK-8222J: 110, 117 or 127 V ±10% AC, 50/60 Hz
	MEK-8222K:220, 230 or 240 V ±10% AC, 50/60 Hz
Power consumption:	360 VA

Dimensions and Weight

Dimensions: 613 W × 550 D × 583 H (mm)
Net weight: approx. 55 kg

Electromagnetic Compatibility

IEC 61326-1 (1997) Amendment 1 (1998) Amendment 2 (2000)
EN 61326-1 (1997) Amendment 1 (1998)

CISPR11 (1997), Group 1, Class B
EN 55011 (1998) Amendment 1 (1999), Group 1, Class B

Safety

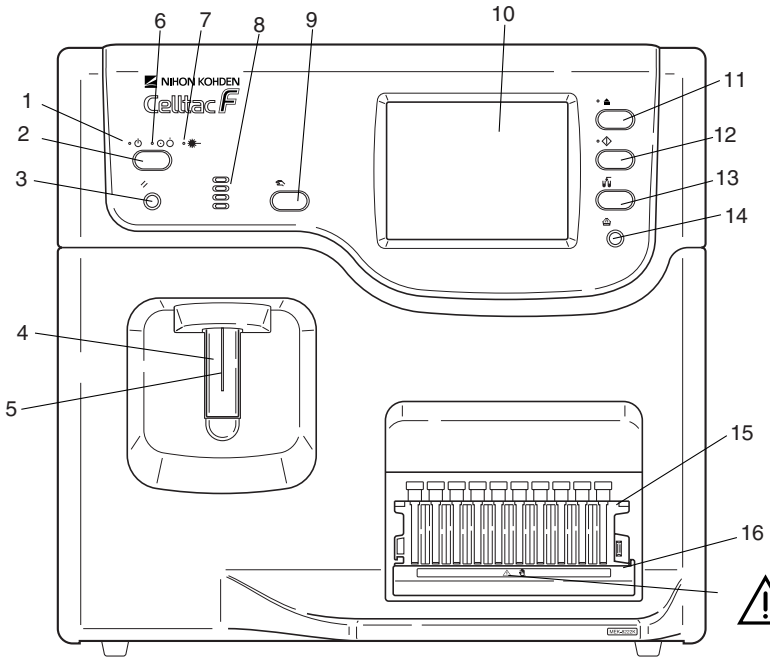
Safety standards: IEC 61010-1 2nd Edition (2001)
EN 61010-1 (1993) Amendment 2 (1995)

Laser: IEC 60825-1 (1993) Amendment 1 (1997)
EN 60825-1 (1994) Amendment 11 (1996)

According to the type of protection against electrical shock: CLASS I EQUIPMENT
According to the degree of protection against harmful ingress of water: IPX0 (Ordinary EQUIPMENT)
According to the degree of safety of application in the presence of a FLAMMABLE ANAESTHETIC MIXTURE WITH AIR, OR WITH OXYGEN OR NITROUS OXIDE: EQUIPMENT not suitable for use in the presence of FLAMMABLE ANAESTHETIC MIXTURE WITH AIR, OR WITH OXYGEN OR NITROUS OXIDE
According to the mode of operation: CONTINUOUS OPERATION
EQUIPMENT types (classification): Indoor stationary EQUIPMENT
Installation Category: II EQUIPMENT
Pollution Degree: 2 EQUIPMENT
Requirements for marking of in vitro diagnostic instruments: EN1658 (1996)

Panel Descriptions

Front Panel

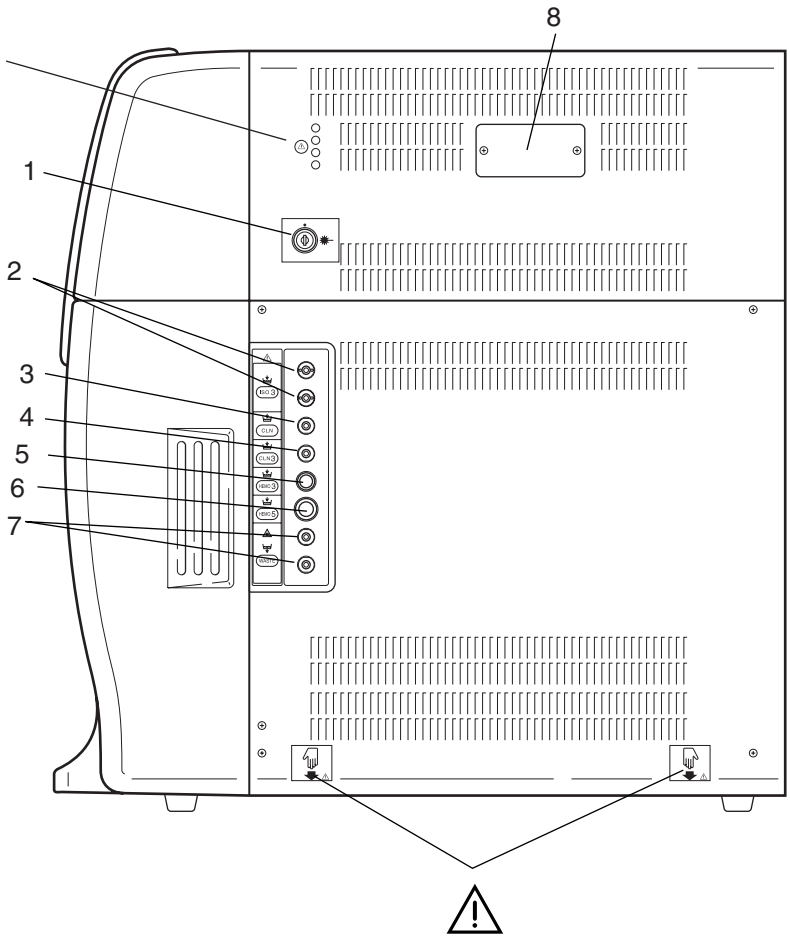


CAUTION

Do not put your hand in the rack table during measurement.

No.	Name	Description
1	Main power lamp	Lights when the main power switch on the rear panel is turned on.
2	Power key	Turns the hematology analyzer power on or off when the main power switch on the rear panel is turned on. When the power is turned on, priming and self-check are automatically performed, and the READY screen is displayed.
3	Reset key	Stops operation when pressed during operation. Returns to the READY screen when pressed while changing settings. Use this key only when an error occurs.
4	Manual count switch	For manual mode only. Press to aspirate the sample and start counting.
5	Manual sampling nozzle	For manual mode only. Aspirates the sample.
6	Power lamp	Lights when the main power switch on the rear panel and power key on the front panel are turned on.
7	Laser lamp	Lights when the laser switch on the right side panel is turned on.
8	Operation indicator lamps	For manual mode only. When blinking: Aspirating the sample When off: Counting the sample When lit: Ready for next counting
9	Manual mode key	Sets the measurement mode in manual mode when pressed. The sampling nozzle for manual mode is lowered.
10	LCD screen	Displays measurement data, various messages and touch screen keys.
11	Eject key	For rack mode only. Press this key to slide the sample rack in or out.
12	Start key	For rack mode only. Press this key to start measurement.
13	Emergency key	Press this key to count an emergency sample during routine counting.
14	Clean key	Cleans the fluid path, aperture and manometer with detergent. Priming is performed automatically after cleaning the fluid path. Press this key when clogging occurs, the manometer becomes dirty or bubbles occur in the manometer.
15	Sample rack	Holds the sample tubes containing specimens. Up to 50 sample tubes can be accommodated.
16	Rack table	Holds the sample rack.

Right Side Panel



CAUTION

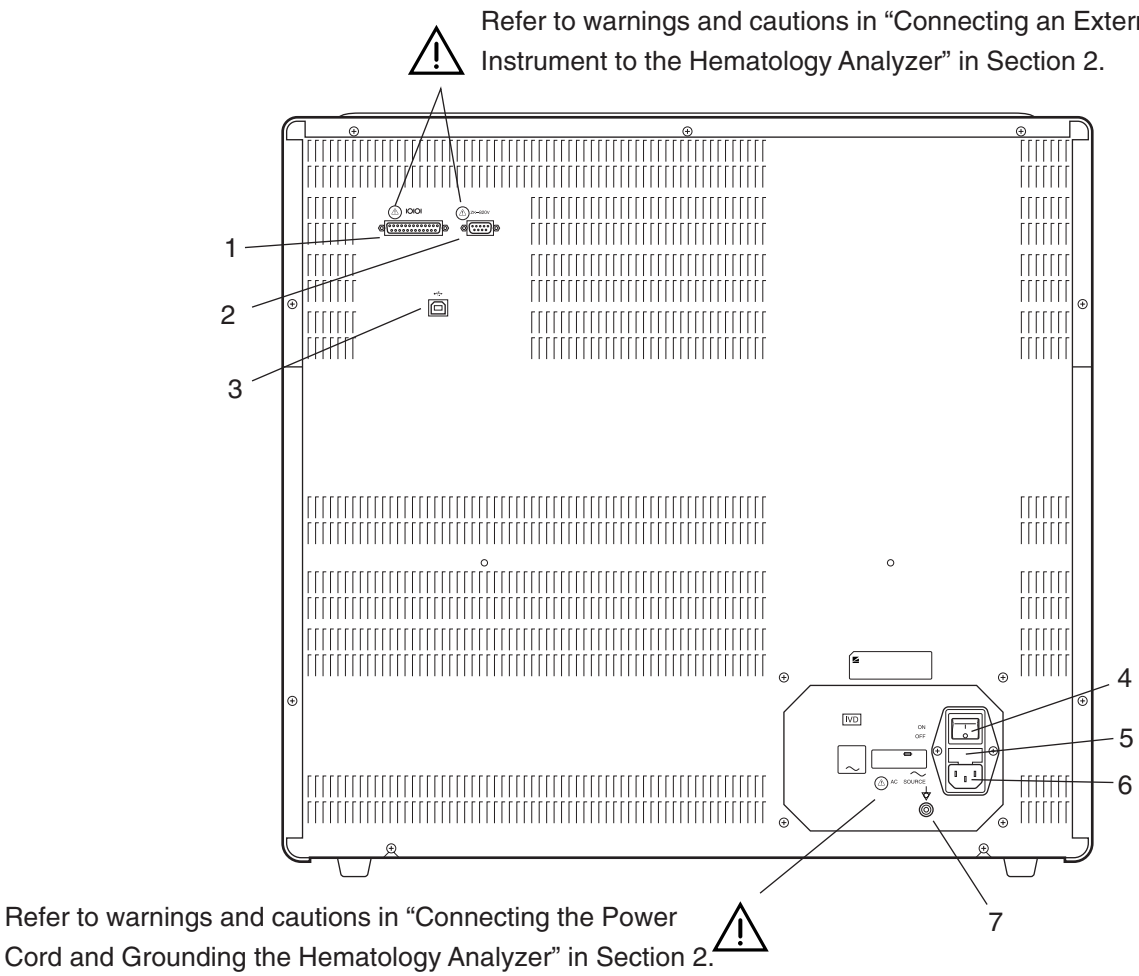
Do not insert an object, such a pencil into these holes. Otherwise the liquid sensor unit may be damaged.

CAUTION

Always carry the hematology analyzer by more than two people and by the left and right sides. Never hold it by the front and rear. Otherwise the front panel may come off and the hematology analyzer may be dropped, causing injury to the operator and damage to the hematology analyzer.

No.	Name	Description
1	Laser switch	Turns the laser on or off with the laser key for WBC 5 part differential measurement.
2	ISO3 Diluent inlets	Inlets for the ISOTONAC•3 diluent.
3	CLN Detergent inlet	Inlet for the CLEANAC detergent.
4	CLN3 Detergent inlet	Inlet for the CLEANAC•3 detergent.
5	HEMO3 Hemolysing reagent inlet	Inlet for the HEMOLYNAC•3 hemolysing reagent.
6	HEMO5 Hemolysing reagent inlet	Inlet for the HEMOLYNAC•5 hemolysing reagent.
7	WASTE Waste outlets	Outlets for waste such as used lyse, detergent and aspirated samples.
8	Flow cell unit window cover	When two screws and the cover are removed, you can see the flow cell unit. Open the window only when adjusting the gain.

Rear Panel

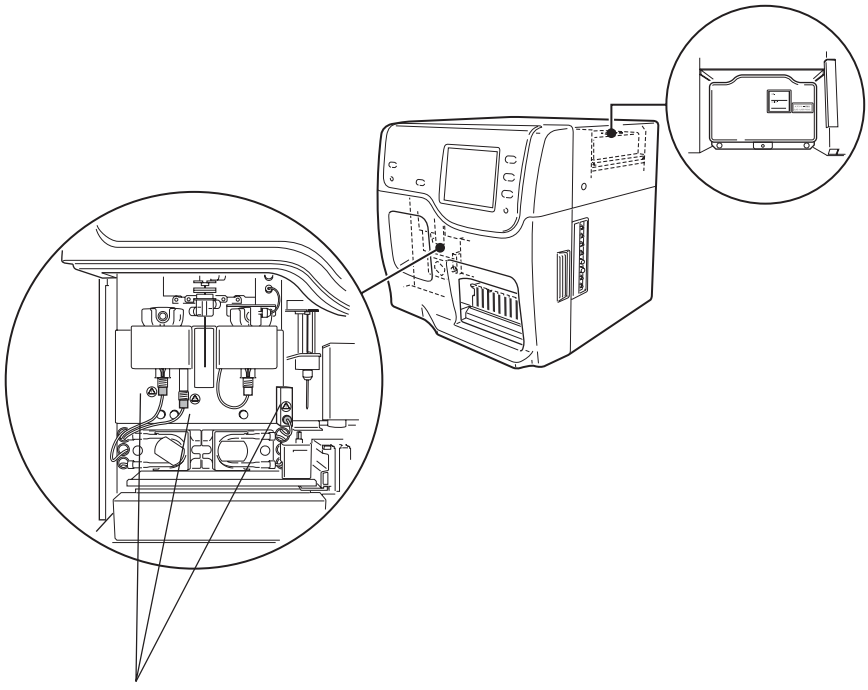

Refer to warnings and cautions in “Connecting an External Instrument to the Hematology Analyzer” in Section 2.
1
2
3
4
5
6
7
Refer to warnings and cautions in “Connecting the Power Cord and Grounding the Hematology Analyzer” in Section 2.

No.	Name	Description
1	RS232C socket	Connects to the optional WA-460V card printer, WA-711V printer, WA-820V printer or PC. When a PC is connected to this socket, histogram and scattergram data cannot be output.
2	Bar code socket	Connects to the optional ZK-820V handy bar code reader.
3	USB socket	Connects to a PC. Histogram and scattergram data can be output.
4	Main power switch	Supplies the power to the hematology analyzer when it is turned on. Under normal conditions keep this switch turned on.
5	Fuse holder	Contains the time lag fuse. To replace the fuse, contact your Nihon Kohden distributor.
6	AC SOURCE AC source socket	Connects the AC power cord to supply AC power to the hematology analyzer.
7	Equipotential ground terminal	Connects the ground lead to the equipotential ground terminal on the wall for earth grounding.

Inside Panels

CAUTION

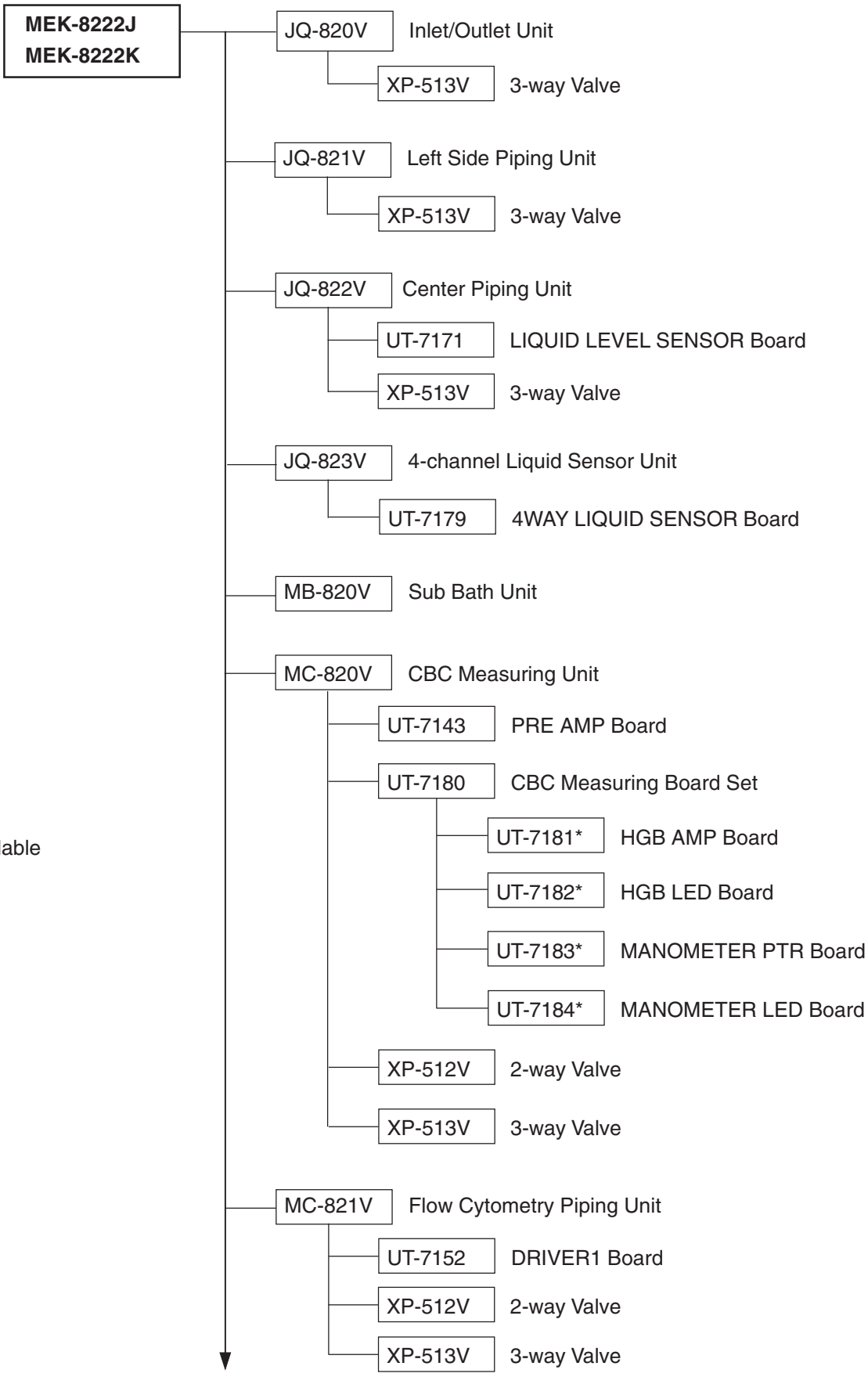
- **For WBC 5 part differential measurement, the laser beam is used. Do not open any part labeled "CAUTION". The laser can cause burns and blindness.**
- **Do not remove the caution labels.**



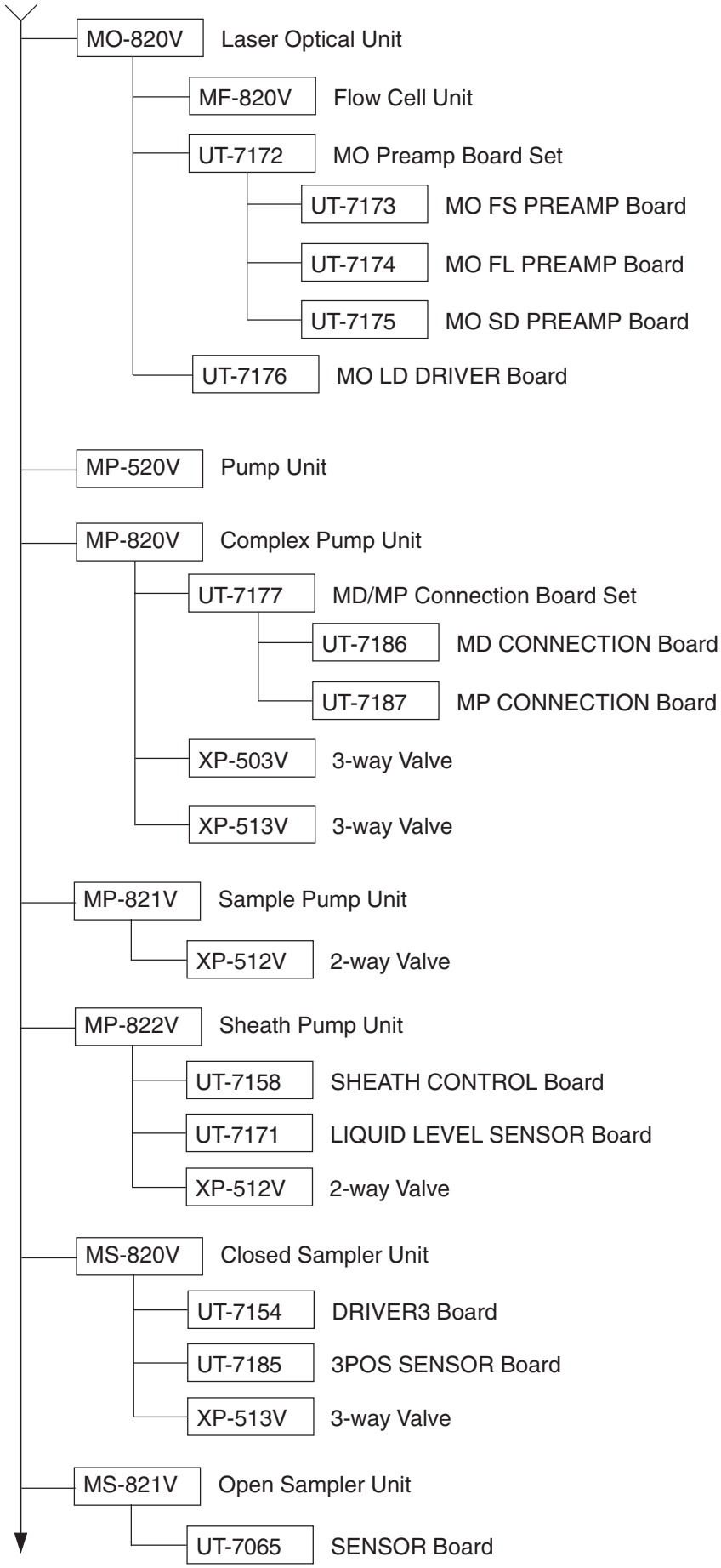
NOTE

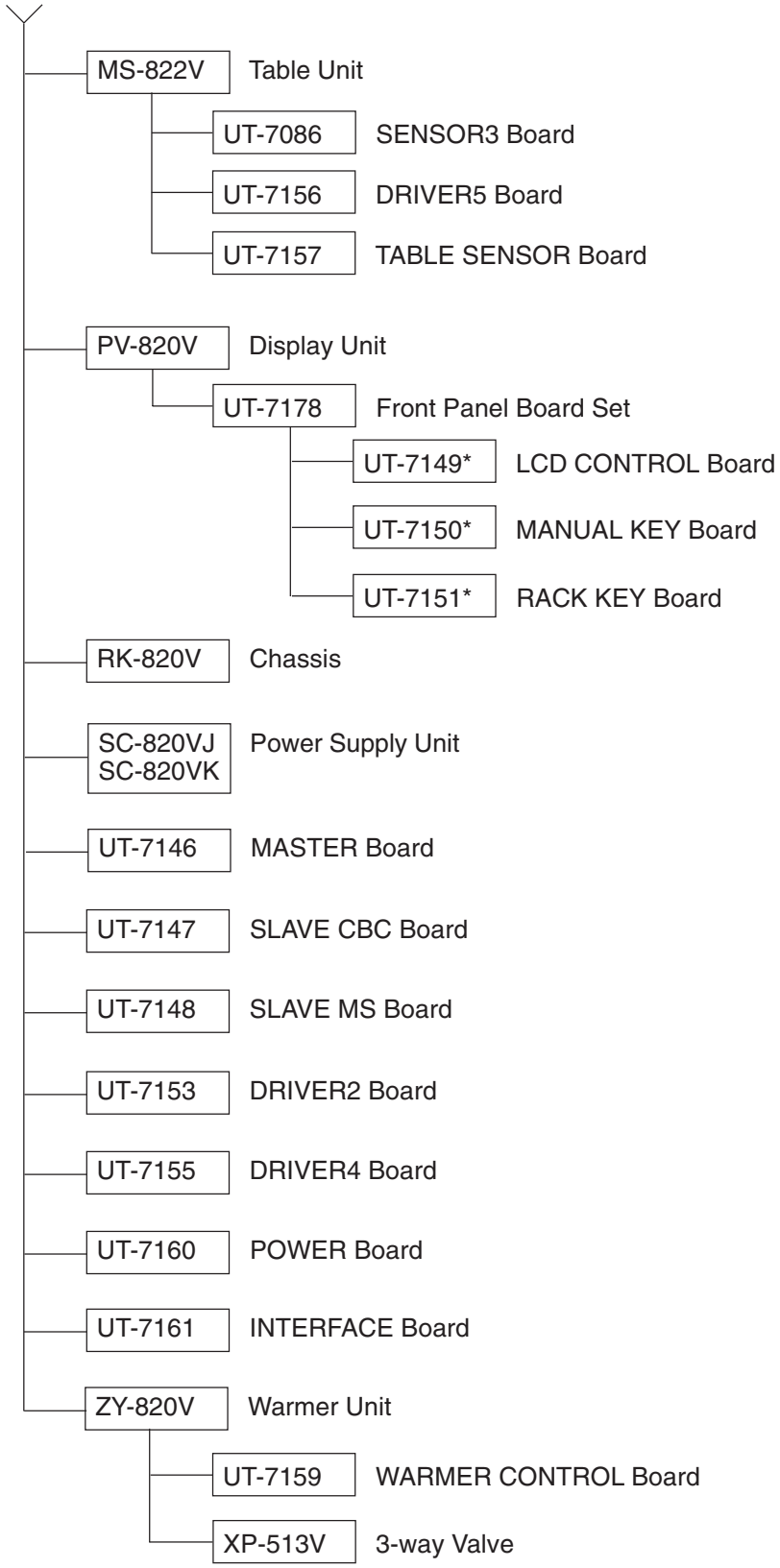
- **When attaching the filter joint assembly, be careful not to bend or damage the filter packing at the bottom of the measurement bath.**
- **When there is a leakage, check that there is no scratch or damage to the circumference of the filter.**

Composition



* Not available


MO-820V
Laser Optical Unit
MF-820V
Flow Cell Unit
UT-7172
MO Preamp Board Set
UT-7173
MO FS PREAMP Board
UT-7174
MO FL PREAMP Board
UT-7175
MO SD PREAMP Board
UT-7176
MO LD DRIVER Board
MP-520V
Pump Unit
MP-820V
Complex Pump Unit
UT-7177
MD/MP Connection Board Set
UT-7186
MD CONNECTION Board
UT-7187
MP CONNECTION Board
XP-503V
3-way Valve
XP-513V
3-way Valve
MP-821V
Sample Pump Unit
XP-512V
2-way Valve
MP-822V
Sheath Pump Unit
UT-7158
SHEATH CONTROL Board
UT-7171
LIQUID LEVEL SENSOR Board
XP-512V
2-way Valve
MS-820V
Closed Sampler Unit
UT-7154
DRIVER3 Board
UT-7185
3POS SENSOR Board
XP-513V
3-way Valve
MS-821V
Open Sampler Unit
UT-7065
SENSOR Board



* Not available

Installation Flow Chart

Place the instrument in a suitable place.
Connect the power cord, reagents and external equipment to the instrument.

↓

Turn on the instrument.

↓

Prime the instrument.

MENU

↓

OTHER OPERATIONS

↓

PRIME ON INSTALLATION

[PRIME ON INSTALLATION] is special procedure after storing and transporting the instrument.

↓

Change the OPERATOR to [FACTORY] to service the instrument.

Display the [OPERATORS & PASSWORDS] screen.

MENU

↓

SETTINGS

↓

OPERATORS & PASSWORDS

↓

Select [FACTORY].

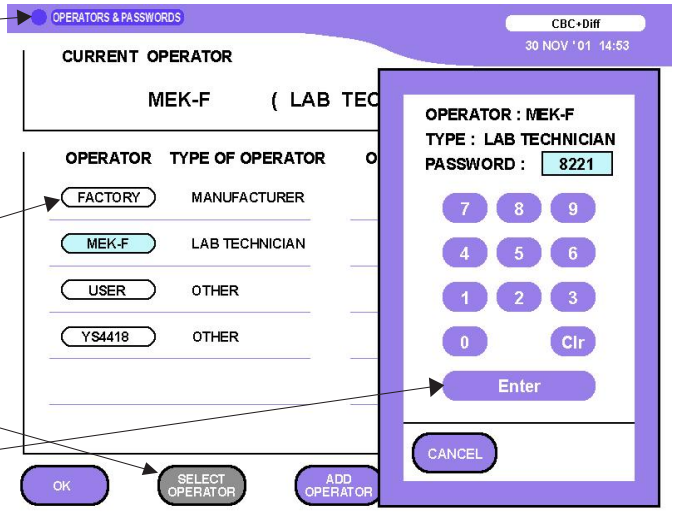
FACTORY

↓

SELECT OPERATOR

↓

Enter the passwords.
[4321]
[Enter]



The status bar on the screen is displayed in orange.

MEK-8222 has 3 default operator types.
1. MANUFACTURER : password [4321] for servicing
   Allows you to enter any screen and change any settings.
2. LAB TECHNICIAN: password [8222]
   Allows you to enter any screen and change settings except for the [SERVICE MAINTENANCE] screen.
3. OTHER: password [0000]
   Allows you to only perform the measurement and view the data and settings.

Operator name [MEK-F](Type of Operator: LAB TECHNICIAN) is selected as the default setting.

Check the laser optical unit and roughly adjust the gain with 7 µm polymer microsphere suspensions.

Display the [DIFF GAIN (ROUGH)] screen.

MENU

SETTINGS

SENSITIVITY & THRESHOLD

DIFF GAIN

Measure the 7 µm polymer microsphere suspensions.

Adjust the flow cell position.

Remove the flow cell unit window cover and loosen the screw fastening the flow cell adjustment screw.

Turn the flow cell adjustment screw about 2 or 3˚

Perform [CLEAN FLOW CELL] procedure.

MENU

OTHER OPERATIONS

CLEAN FLOW CELLS

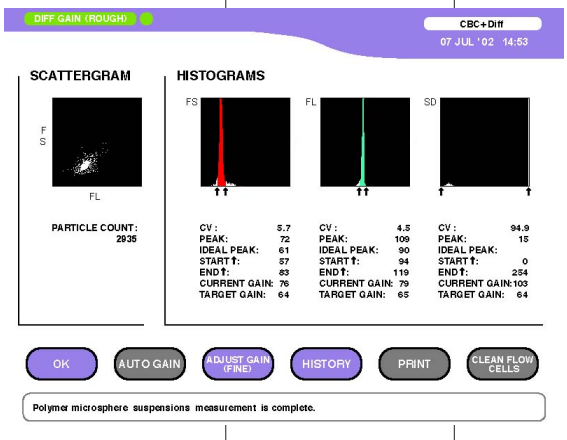
FS CV must be 7% or less. FL CV must be 7% or less.

Is CV OK ?

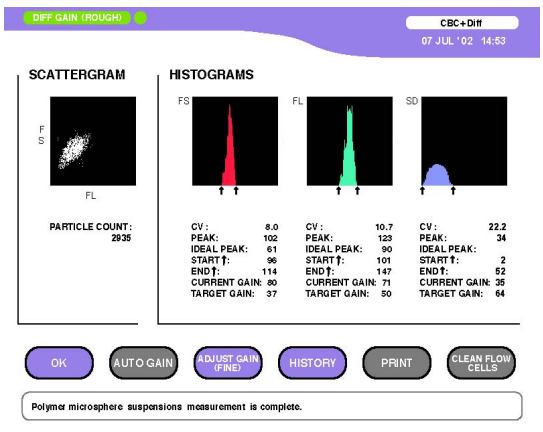
NO

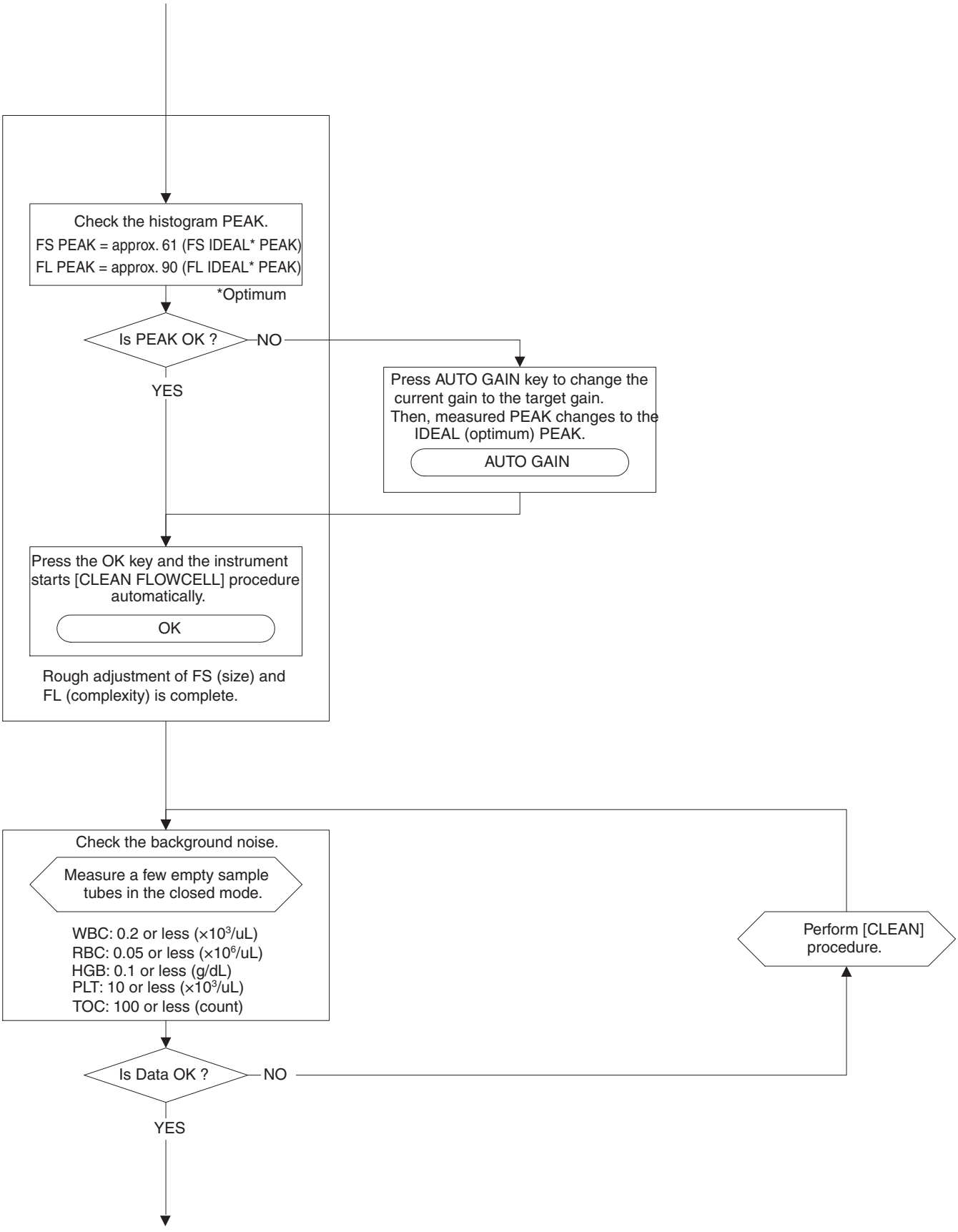
YES

This result is optimum, the CV values of FS and FL are below 7%. The histogram is narrow and scattergram is small oval shape as shown below.



If the result is not optimum, the CV values of FS and FL are over 7%. The histogram is wide and scattergram is large as shown below.




Check the histogram PEAK.
FS PEAK = approx. 61 (FS IDEAL* PEAK)
FL PEAK = approx. 90 (FL IDEAL* PEAK)
*Optimum
Is PEAK OK ?
NO
YES
Press AUTO GAIN key to change the current gain to the target gain.
Then, measured PEAK changes to the IDEAL (optimum) PEAK.
AUTO GAIN
Press the OK key and the instrument starts [CLEAN FLOWCELL] procedure automatically.
OK
Rough adjustment of FS (size) and FL (complexity) is complete.
Check the background noise.
Measure a few empty sample tubes in the closed mode.
WBC: 0.2 or less (×10³/uL)
RBC: 0.05 or less (×10⁶/uL)
HGB: 0.1 or less (g/dL)
PLT: 10 or less (×10³/uL)
TOC: 100 or less (count)
Perform [CLEAN] procedure.
Is Data OK ?
NO
YES

YES

Perform fine adjustment of the gain with human blood samples.

Prepare 10 blood samples of different healty people within 12 hours after the blood collection.

Measure the 10 human blood samples in the closed mode.

Call up the [DIFF GAIN (FINE)] screen.

MENU

SETTINGS

SENSITIVITY & THRESHOLD

DIFF GAIN

ADJUST GAIN (FINE)

Load the scattergram and calculate the target gain.

Enter the measured sample's sequence number.

LOAD NEW SCATTERGRAM

ADD TO LIST

MO PEAK (FS,FL,SD) is displayed. But, the measured PEAK may be different from the IDEAL PEAK and the scattergram can touch the division line.

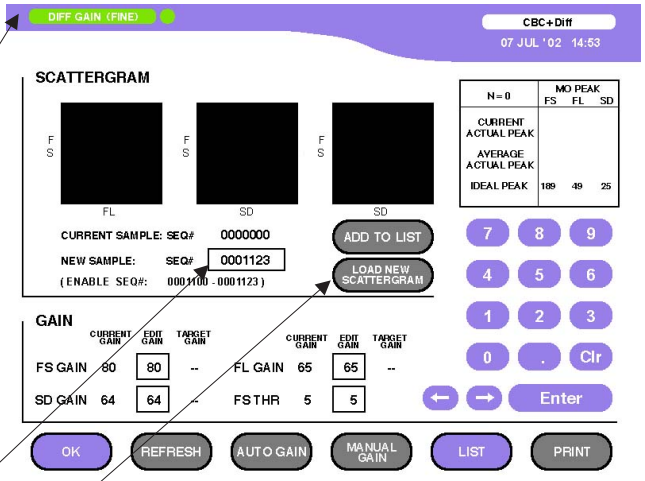
Press the AUTO GAIN key to change the current gain to the target gain. Then, the measured PEAK changes to the IDEAL PEAK.

AUTO GAIN

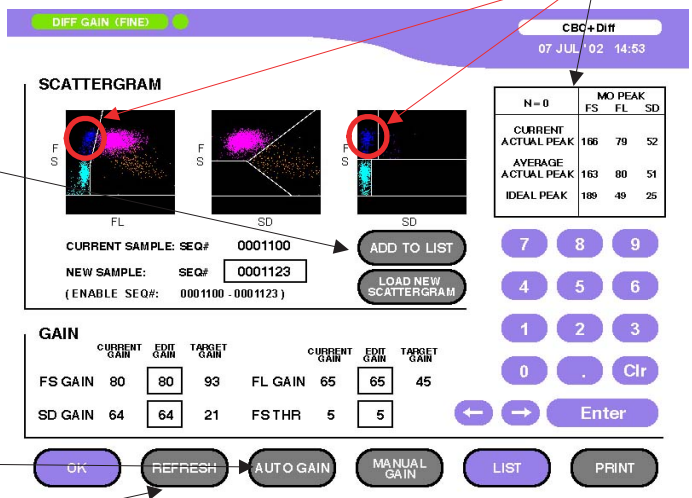
Draw the scattergram with the changed GAIN.

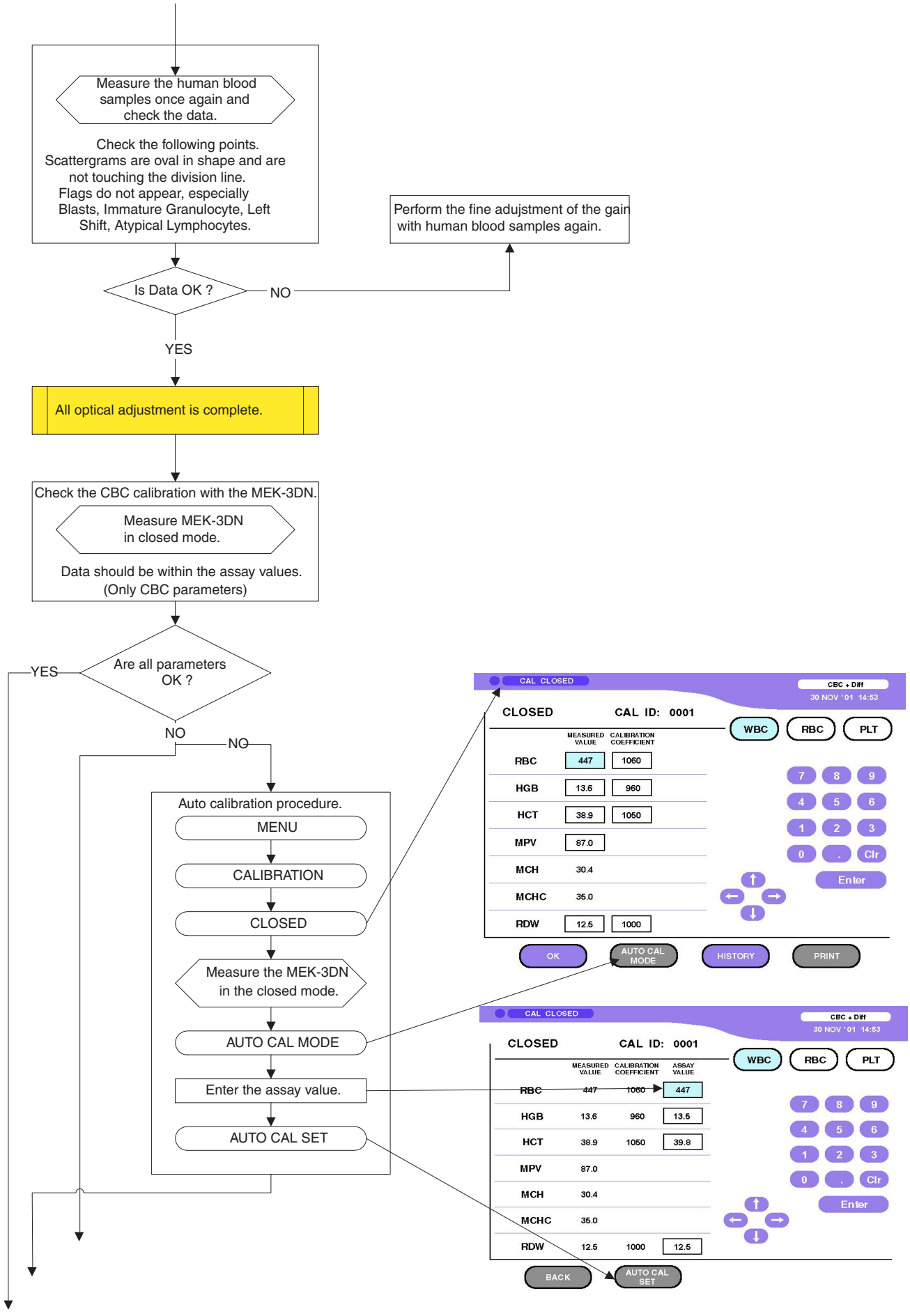
REFRESH

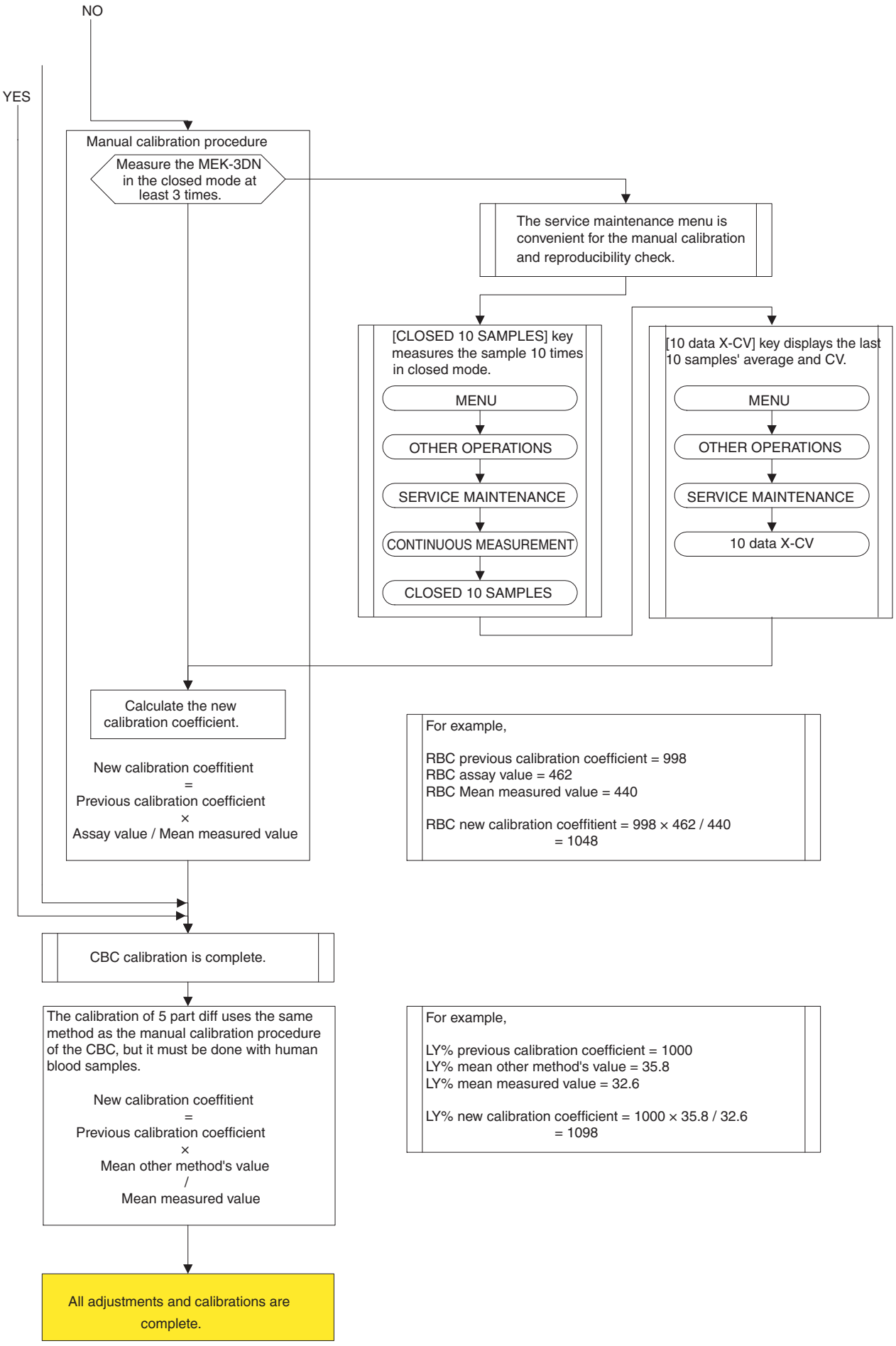
Rough adjustment of FS (size) and FL (complexity) with 7um particle is already completed .
Adjustment of SD (granularity) is not yet completed.



Since the PEAK of Monocyte of human blood is the most stable parameter in WBC 5 part-diff, the optical fine adjustment is done with the MO PEAK.




Measure the human blood samples once again and check the data.
Check the following points.
Scattergrams are oval in shape and are not touching the division line.
Flags do not appear, especially Blasts, Immature Granulocyte, Left Shift, Atypical Lymphocytes.
Perform the fine adujstment of the gain with human blood samples again.
Is Data OK ?
NO
YES
All optical adjustment is complete.
Check the CBC calibration with the MEK-3DN.
Measure MEK-3DN in closed mode.
Data should be within the assay values. (Only CBC parameters)
Are all parameters OK ?
YES
NO
NO
Auto calibration procedure.
MENU
CALIBRATION
CLOSED
Measure the MEK-3DN in the closed mode.
AUTO CAL MODE
Enter the assay value.
AUTO CAL SET
CAL CLOSED
CBC + Diff
30 NOV '01 14:53
CLOSED
CAL ID: 0001
WBC
RBC
PLT
MEASURED VALUE
CALIBRATION COEFFICIENT
RBC 447 1060
HGB 13.6 960
HCT 38.9 1050
MPV 87.0
MCH 30.4
MCHC 35.0
RDW 12.5 1000
7 8 9
4 5 6
1 2 3
0 . Clr
Enter
OK
AUTO CAL MODE
HISTORY
PRINT
CAL CLOSED
CBC + Diff
30 NOV '01 14:53
CLOSED
CAL ID: 0001
WBC
RBC
PLT
MEASURED VALUE
CALIBRATION COEFFICIENT
ASSAY VALUE
RBC 447 1060 447
HGB 13.6 960 13.5
HCT 38.9 1050 39.8
MPV 87.0
MCH 30.4
MCHC 35.0
RDW 12.5 1000 12.5
7 8 9
4 5 6
1 2 3
0 . Clr
Enter
BACK
AUTO CAL SET


NO
YES
Manual calibration procedure
Measure the MEK-3DN in the closed mode at least 3 times.
The service maintenance menu is convenient for the manual calibration and reproducibility check.
[CLOSED 10 SAMPLES] key measures the sample 10 times in closed mode.
MENU
OTHER OPERATIONS
SERVICE MAINTENANCE
CONTINUOUS MEASUREMENT
CLOSED 10 SAMPLES
[10 data X-CV] key displays the last 10 samples' average and CV.
MENU
OTHER OPERATIONS
SERVICE MAINTENANCE
10 data X-CV
Calculate the new calibration coefficient.
New calibration coeffitient
=
Previous calibration coefficient
×
Assay value / Mean measured value
For example,
RBC previous calibration coefficient = 998
RBC assay value = 462
RBC Mean measured value = 440
RBC new calibration coeffitient = 998 × 462 / 440
= 1048
CBC calibration is complete.
The calibration of 5 part diff uses the same method as the manual calibration procedure of the CBC, but it must be done with human blood samples.
New calibration coeffitient
=
Previous calibration coefficient
×
Mean other method's value
/
Mean measured value
For example,
LY% previous calibration coefficient = 1000
LY% mean other method's value = 35.8
LY% mean measured value = 32.6
LY% new calibration coefficient = 1000 × 35.8 / 32.6
= 1098
All adjustments and calibrations are complete.

How to Upgrade the Software

Instruments with a serial number between 00001 and 000xx require the following ROM replacement before the software upgrade. Therefore, check the serial number on the rear panel of the instrument. If the serial number is not in the above-mentioned serial numbers, go to “Upgrading the Software with Memory Card”.

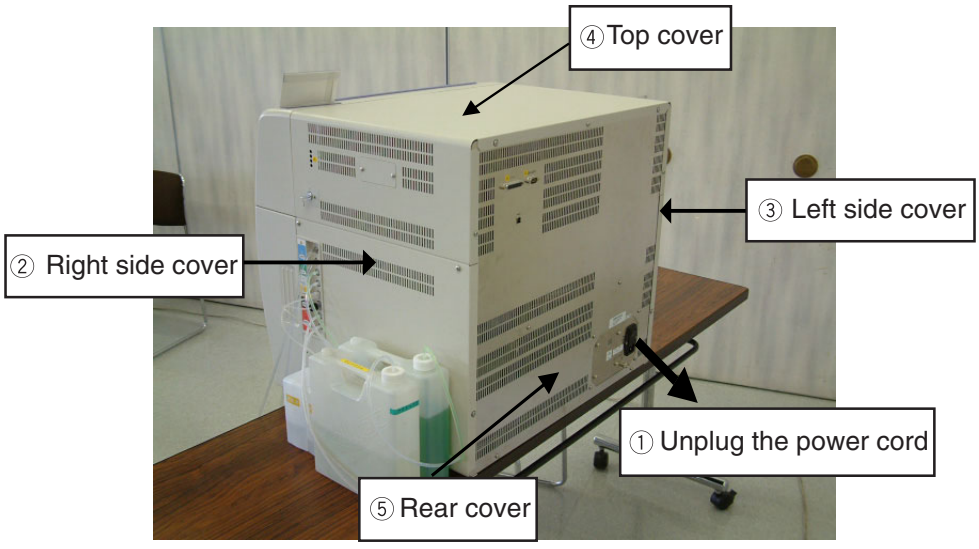
Replacing the ROM

1. Turn off the main power switch on the rear panel of the instrument and unplug the AC power cord.

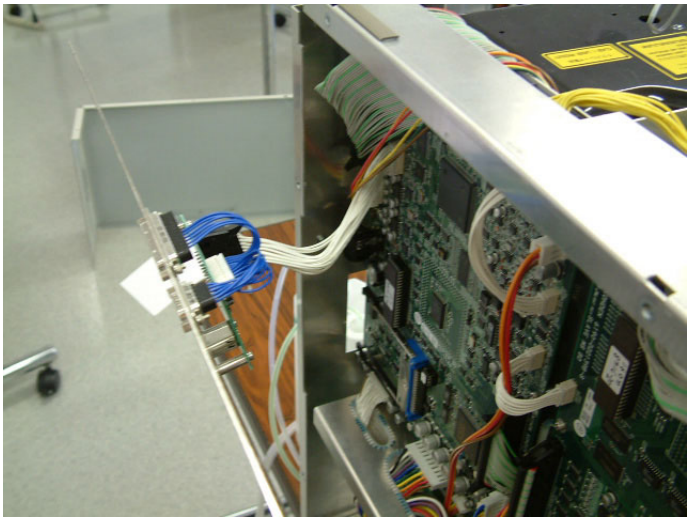
CAUTION

Before removing any parts from the instrument, wait 10 minutes after turning off the instrument and disconnecting the power cord from the AC outlet.

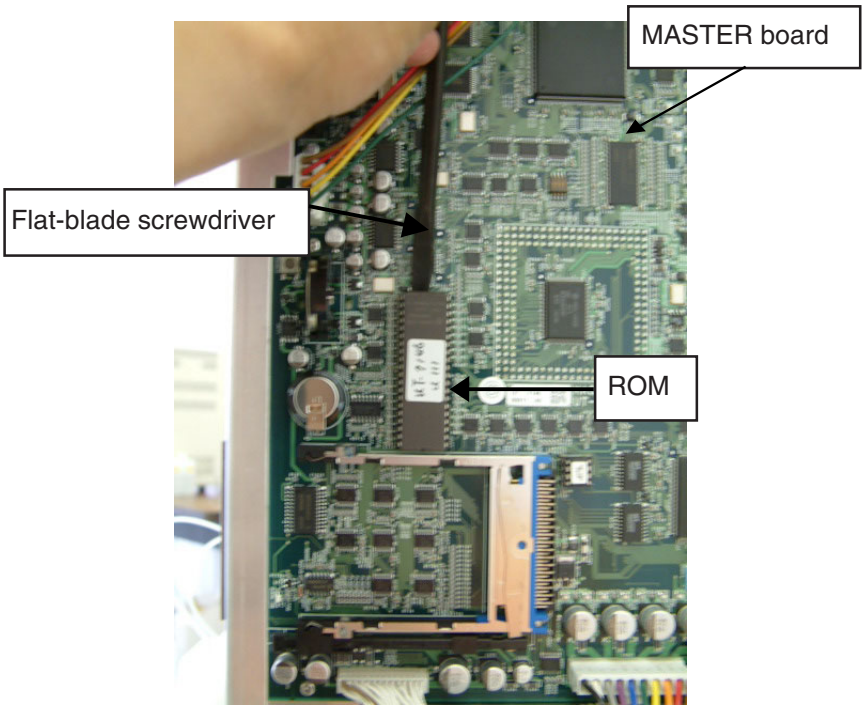
2. Remove the screws which secure the side covers and top cover to the instrument chassis. Remove the covers from the instrument.



3. Remove the screws which secure the rear cover to the instrument chassis. Slowly pull the rear cover toward you until the cable connected to the rear cover backside appears as shown below. Disconnect the cable at the INTERFACE board which is attached to the rear cover. Completely remove the rear cover from the instrument.

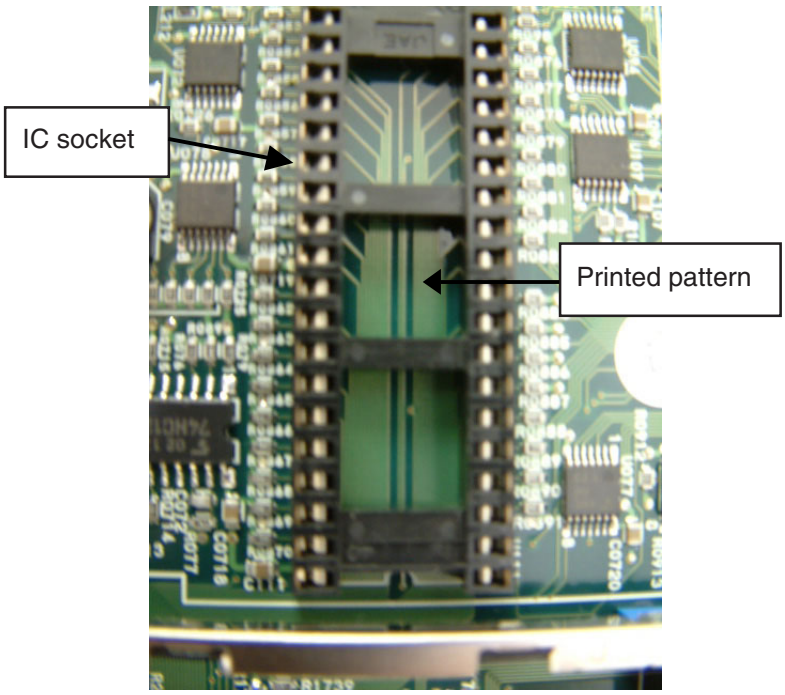


4. Insert a small flat-blade screwdriver between the ROM and its socket on the MASTER board as shown below. Carefully lift the ROM with the screwdriver until the ROM slightly tilts. Take out the screwdriver and insert it into the opposite side of the IC socket. Continue lifting both sides of the ROM with the screwdriver until the ROM is removed.



CAUTION

When you remove the ROM from the IC socket with a sharp edge tool such as a flat-blade screwdriver, be sure that it does not damage the printed pattern under the IC socket.



5. Put the new ROM on the IC socket and carefully insert the pins of the new ROM into the IC socket.

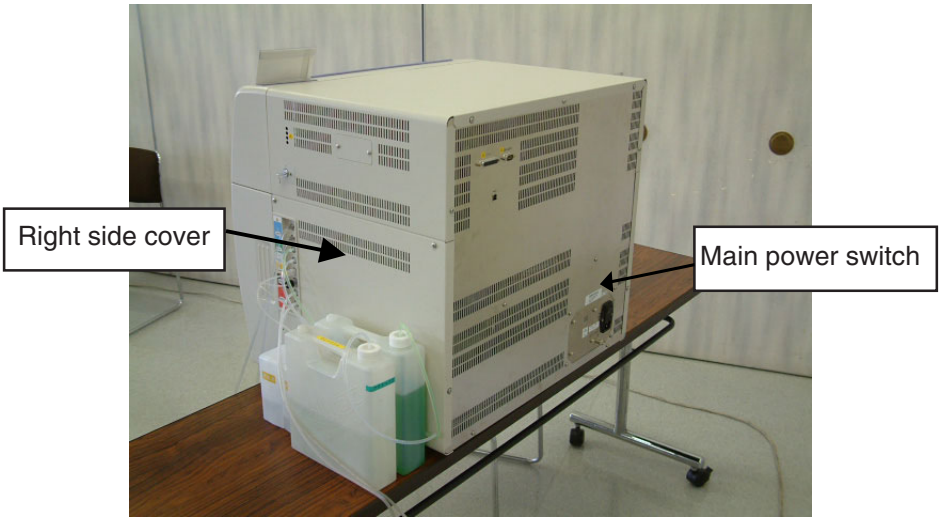
CAUTION

- **Before putting the new ROM on the IC socket, check that the ROM position is the same as the old ROM.**
- **Do not break or bend a pin of the ROM. The pins must be correctly inserted into the socket. Otherwise the instrument may not work.**

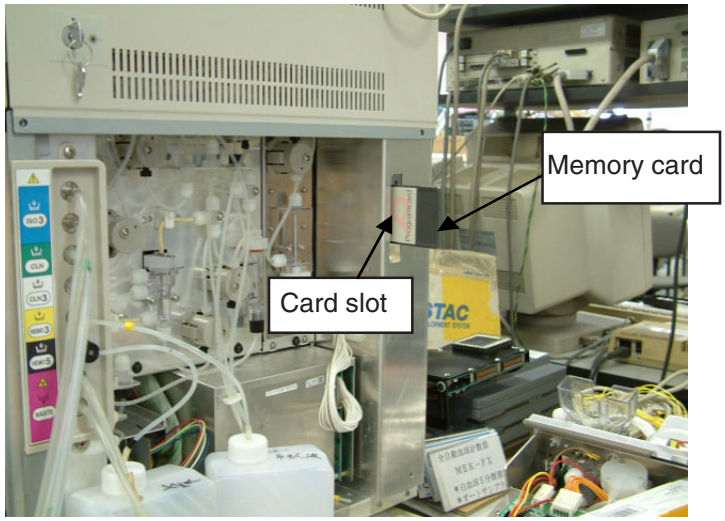
Upgrading the Software with the Memory Card

1. Turn off the main power switch on the rear of the instrument.

2. Remove the right side cover as shown below.

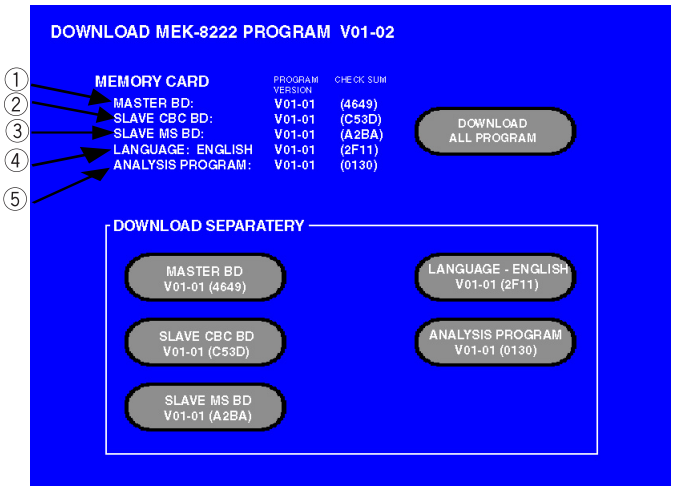


3. Insert the memory card into the slot as shown below.

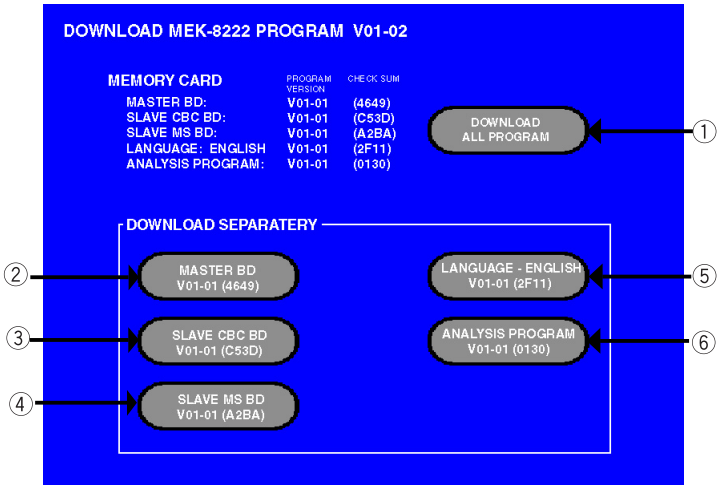


4. Turn on the main power switch on the rear of the instrument.

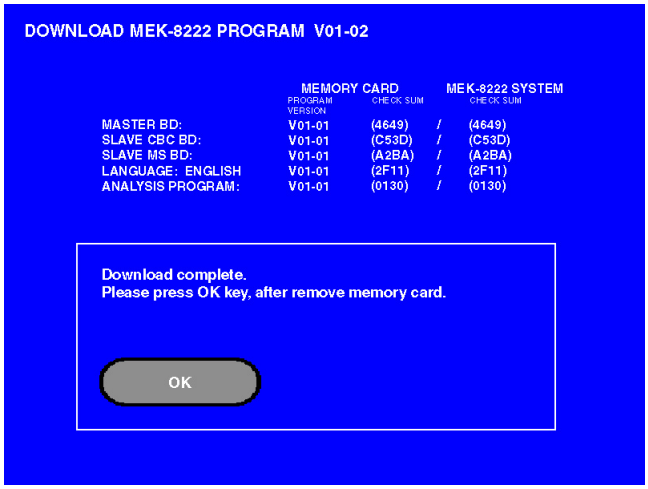
5. Turn on the Power key on the front panel of the instrument.
   The “DOWNLOAD MEK-8222 PROGRAM” screen appears.
   The MEK-8222 software has five parts.
   ① MASTER BD (board)
   ② SLAVE CBC BD (board)
   ③ SLAVE MD BD (board)
   ④ LANGUAGE: ENGLISH (local language program)
   ⑤ ANALYSIS PROGRAM



6. Install the software as follows:
   ① To install all the software, press the DOWNLOAD ALL PROGRAM touch screen key.
   ② To install the MASTER BD software only, press the MASTER BD Vxx-xx (xxxx) key on the screen.
   ③ To install the SLAVE CBC BD software only, press the SLAVE CBC BD Vxx-xx (xxxx) key on the screen.
   ④ To install the SLAVE MS BD software only, press the SLAVE MS BD Vxx-xx (xxxx) key on the screen.
   ⑤ To install the LANGUAGE software, press the LANGUAGE (local language) Vxx-xx (xxxx) key on the screen.
   ⑥ To install the ANALYSYS PROGRAM software only, press the ANALYSYS PROGRAM Vxx-xx (xxxx) key on the screen.



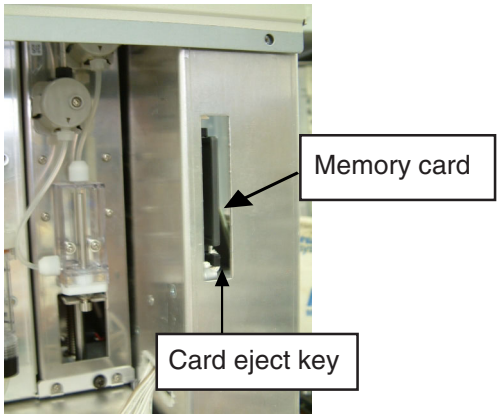
After the software is installed, the following screen appears.


DOWNLOAD MEK-8222 PROGRAM V01-02
MEMORY CARD
PROGRAM VERSION
CHECK SUM
MEK-8222 SYSTEM
CHECK SUM
MASTER BD: V01-01 (4649) / (4649)
SLAVE CBC BD: V01-01 (C53D) / (C53D)
SLAVE MS BD: V01-01 (A2BA) / (A2BA)
LANGUAGE: ENGLISH V01-01 (2F11) / (2F11)
ANALYSIS PROGRAM: V01-01 (0130) / (0130)
Download complete.
Please press OK key, after remove memory card.
OK

7. Press the OK key on the screen.

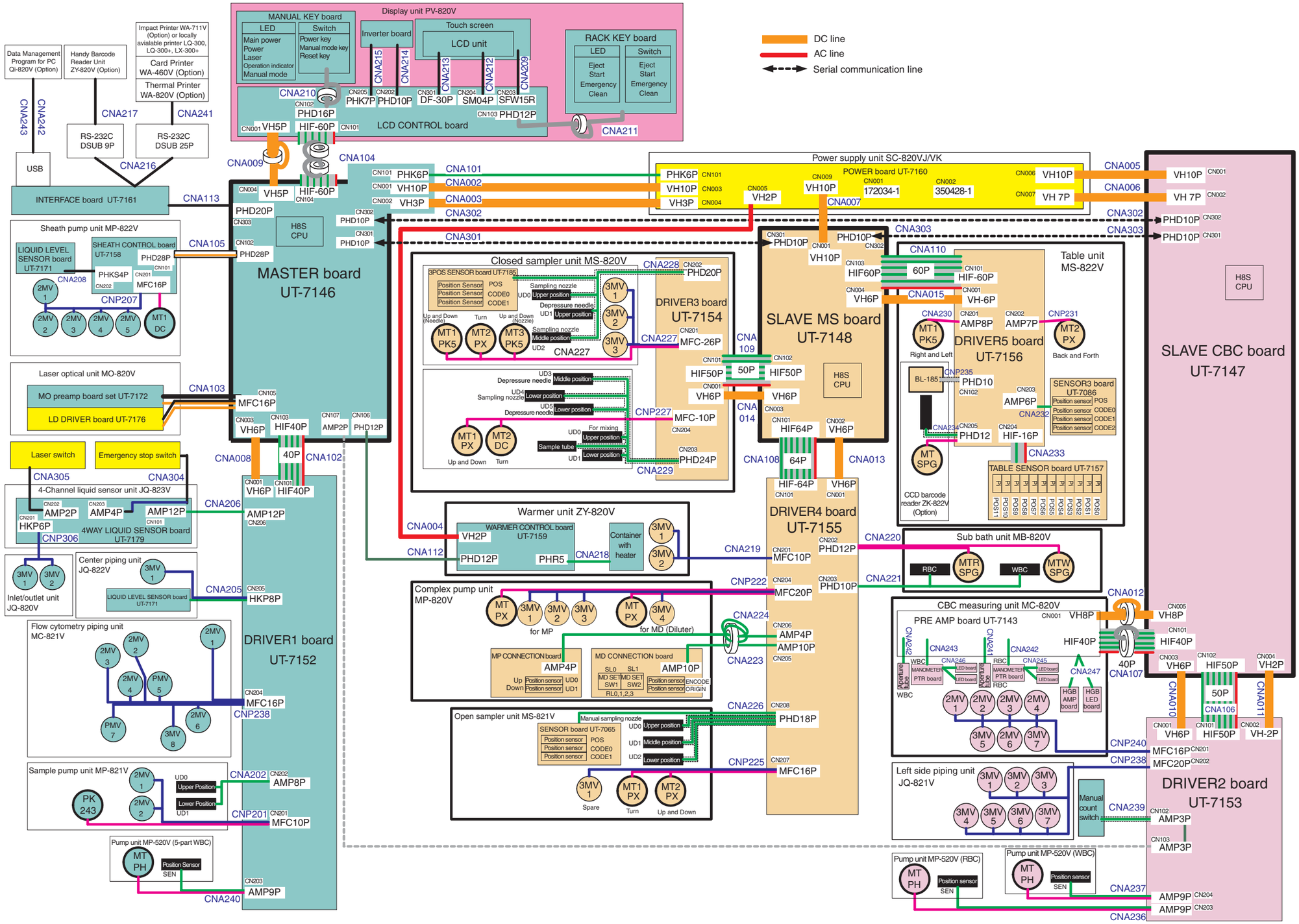
The instrument starts automatic priming.

8. Press the card eject key and remove the memory card from the instrument.

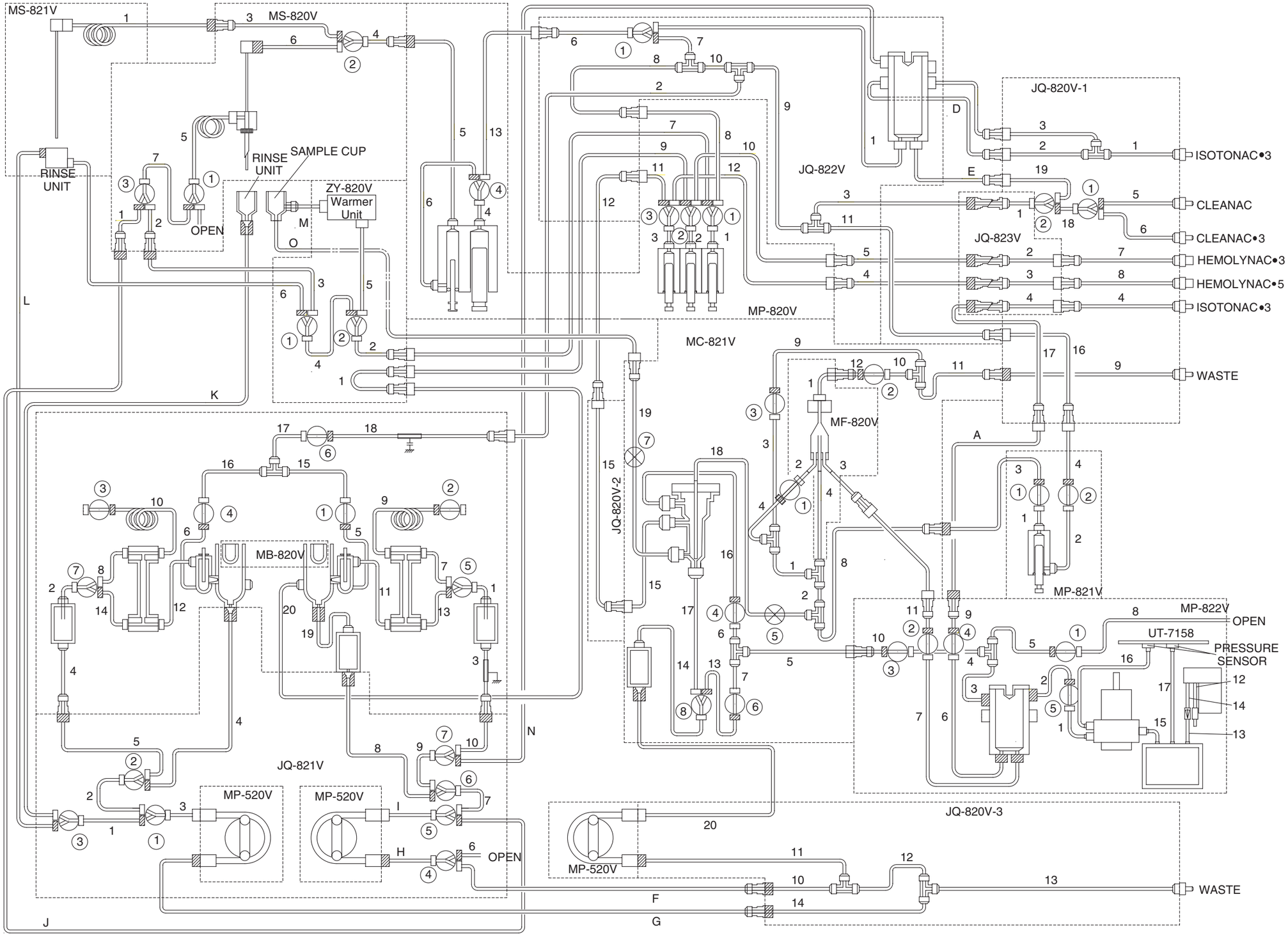


9. Reassemble the instrument completely.

Connection and Wiring Diagram



Hydraulic System Diagram



Tube List

<MC-820V>

Index	Model Number			Remarks
1	YK-	CO	180	
2	YK-	CO	180	
3	YK-	00002		Tube with ground terminal (180 mm long)
4	YK-	OO	090	
5	YK-	DO	160	
6	YK-	DO	160	
7	YK-	CC	140	
8	YK-	CC	150	
9	YK-	CD	640	
10	YK-	CD	280	
11	YK-	CO	150	
12	YK-	CO	150	
13	YK-	CD	180	
14	YK-	CD	200	
15	YK-	CO	090	
16	YK-	CO	090	
17	YK-	CO	050	
18	YK-	00001		Tube with capacitor and ground terminal (240 mm long)
19	YK-	AL	270	
20	YK-	AO	140	

<MC-821V>

Index	Model Number			Remarks
1	YK-	OO	085	
2	YK-	OO	084	
3	YK-	CO	095	
4	YK-	DO	205	
5	YK-	AO	400	
6	YK-	CO	140	
7	YK-	CO	085	
8	YK-	OO	125	
9	YK-	DO	080	
10	YK-	CO	235	
11	YK-	OO	090	
12	YK-	DO	090	
13	YK-	DD	100	
14	YK-	AC	150	
15	YK-	AO	300	
16	YK-	DO	080	
17	YK-	CO	080	
18		547953	55	7.5 m tube
19		547953	60	7.5 m tube

<MP-820V>

Index	Model Number			Remarks
1	YK-	CO	090	
2	YK-	CO	090	
3	YK-	CO	090	
4	YK-	CO	085	
5	YK-	BO	250	
6	YK-	DO	160	
7	YK-	AD	210	
8	YK-	AC	350	
9	YK-	AD	170	
10	YK-	AC	300	
11	YK-	AD	300	
12	YK-	AC	280	
13	YK-	AC	200	

<MP-821V>

Index	Model Number			Remarks
1	YK-	CO	085	
2	YK-	CO	120	
3	YK-	BD	190	
4	YK-	AD	320	

<MS-820V>

Index	Model Number			Remarks
1	YK-	DO	305	
2	YK-	CO	305	
3	YK-	DO	270	
4	YK-	CO	330	
5	YK-	AC	400	
6	YK-	BC	450	
7	YK-	CD	170	

<MS-821V>

Index	Model Number		Remarks
	YK-	00003	Tube with grommet (615 mm long)

<MP-822V>

Index	Model Number			Remarks
1	YK-	CO	130	
2	YK-	BD	120	
3	YK-	BO	065	
4	YK-	CO	160	
5	YK-	DO	150	
6	YK-	BC	250	
7	YK-	BC	325	
8	YK-	CO	320	
9	YK-	DO	110	
10	YK-	DO	160	
11	YK-	DO	210	
12		559147	30	7.5 m tube
13		559147	55	7.5 m tube
14		559147	100	7.5 m tube
15		559147	230	7.5 m tube
16		534102	210	7.5 m tube
17		534102	230	7.5 m tube

Note: To use 7.5 m tube, cut it in the optimal length.

<JQ-820V>

Index	Model Number			Remarks
1	YK-	FO	130	
2	YK-	AO	150	
3	YK-	AO	120	
4	YK-	FO	075	
5	YK-	DF	110	
6	YK-	CF	120	
7	YK-	FO	160	
8	YK-	FO	170	
9	YK-	BF	140	
10	YK-	BO	180	
11	YK-	BO	140	
12	YK-	OO	100	
13	YK-	FO	140	
14	YK-	BO	150	
15	YK-	AO	160	
16	YK-	AO	130	
17	YK-	BO	230	
18	YK-	CD	130	
19	YK-	AC	120	
20	YK-	AL	500	

<JQ-821V>

Index	Model Number			Remarks
1	YK-	CD	150	
2	YK-	CC	100	
3	YK-	AC	330	
4	YK-	DK	330	
5	YK-	BC	310	
6	YK-	DO	030	
7	YK-	CC	100	
8	YK-	DK	320	
9	YK-	CC	100	
10	YK-	BC	290	

<JQ-822V>

Index	Model Number			Remarks
1	YK-	AC	150	
2	YK-	AO	680	
3	YK-	BO	530	
4	YK-	BO	660	
5	YK-	BO	700	
6	YK-	CO	200	
7	YK-	DO	130	
8	YK-	OO	110	
9	YK-	OO	120	
10	YK-	OO	120	
11	YK-	OO	400	
12	YK-	OO	450	

<JQ-823V>

Index	Model Number			Remarks
1	YK-	CO	190	
2	YK-	AO	170	
3	YK-	AO	170	
4	YK-	AO	170	

<ZY-820V>

Index	Model Number			Remarks
1	YK-	OO	210	
2	YK-	CO	110	
3	YK-	BC	300	
4	YK-	CD	130	
5	YK-	AC	160	
6	YK-	AD	350	

<MEK-8222>

Index	Model Number			Remarks
A	YK-	AB	480	
B	YK-	AA	350	
C	YK-	AO	400	
D	YK-	AO	480	
E	YK-	AO	480	
F	YK-	CO	950	
G	YK-	BO	750	
H	YK-	BC	520	
I	YK-	AC	500	
J	YK-	BD	900	
K	YK-	CK	600	
L	YK-	BD	750	
M	YK-	AO	100	
N	YK-	AD	750	
O		532639	470	7.5 m tube

<MF-820V>

Index	Model Number			Remarks
1	YK-	AC	470	
2		532639	200	7.5 m tube
3		532639	200	7.5 m tube
4		532612A	30	Silicon tube 0.5 × 2.3 AE

Standard Accessory

	YK-	00004	Tube for HEMOLYNAC3 (400 mm long)
	YK-	00005	Tube for HEMOLYNAC5 (400 mm long)

Note: To use 7.5 m tube or 100 m tube,
cut it in the optimal length.

Section 2 Troubleshooting

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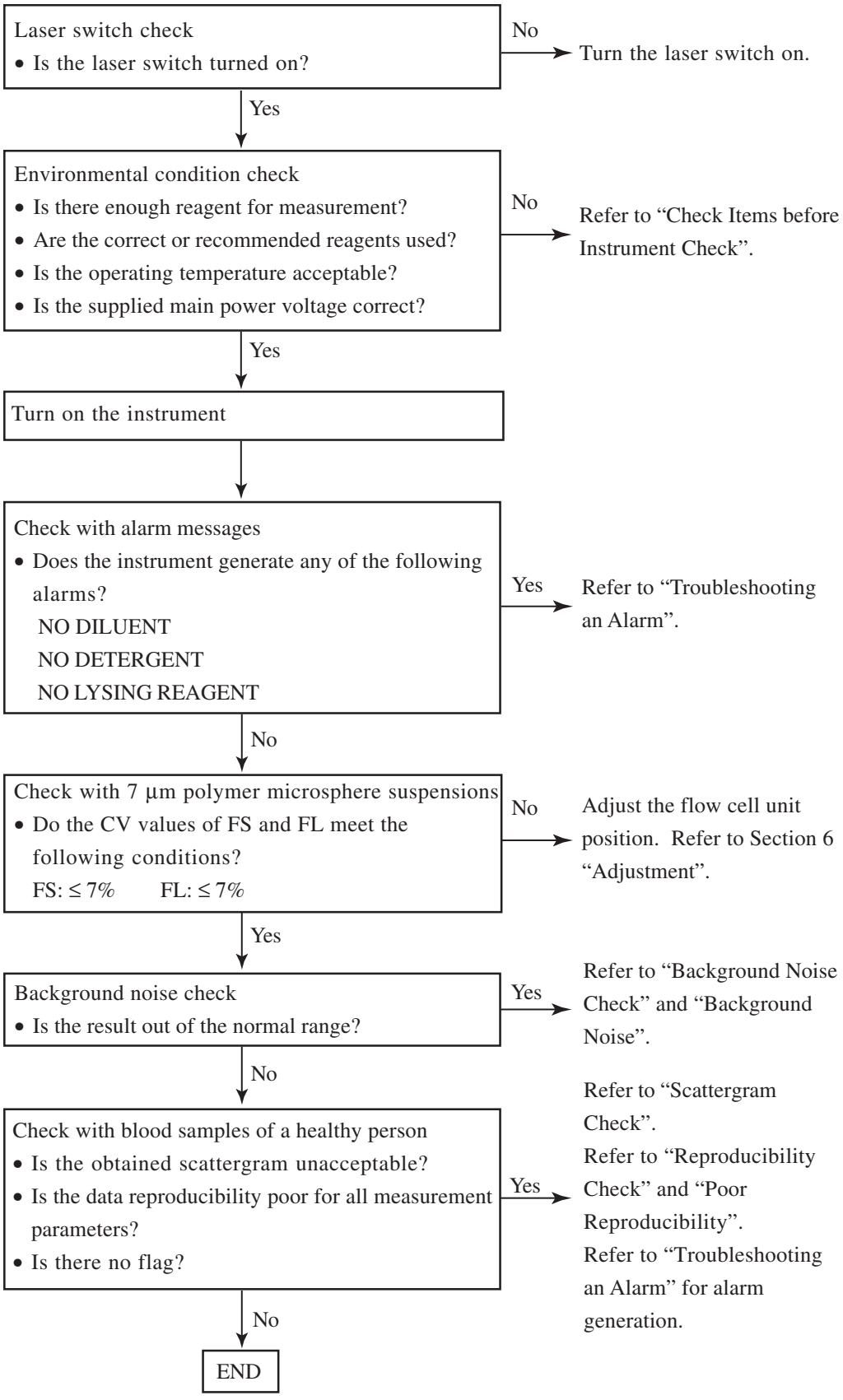
Check Procedure

Check the instrument according to the check procedure below.


Laser switch check
• Is the laser switch turned on?
No
Turn the laser switch on.
Yes
Environmental condition check
• Is there enough reagent for measurement?
• Are the correct or recommended reagents used?
• Is the operating temperature acceptable?
• Is the supplied main power voltage correct?
No
Refer to "Check Items before Instrument Check".
Yes
Turn on the instrument
Check with alarm messages
• Does the instrument generate any of the following alarms?
NO DILUENT
NO DETERGENT
NO LYSING REAGENT
Yes
Refer to "Troubleshooting an Alarm".
No
Check with 7 µm polymer microsphere suspensions
• Do the CV values of FS and FL meet the following conditions?
FS: ≤ 7% FL: ≤ 7%
No
Adjust the flow cell unit position. Refer to Section 6 "Adjustment".
Yes
Background noise check
• Is the result out of the normal range?
Yes
Refer to "Background Noise Check" and "Background Noise".
No
Check with blood samples of a healthy person
• Is the obtained scattergram unacceptable?
• Is the data reproducibility poor for all measurement parameters?
• Is there no flag?
Yes
Refer to "Scattergram Check".
Refer to "Reproducibility Check" and "Poor Reproducibility".
Refer to "Troubleshooting an Alarm" for alarm generation.
No
END

Background Noise Check

Measuring Background Noise

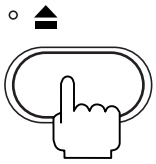
Background noise increases in the following cases.

Problem	Countermeasure
Old diluent. Germs begin to breed in the diluent 6 months after opening.	Replace diluent.
Dust in the diluent container.	Replace diluent.
Extremely high or low diluent temperature (normal range is 15 to 30°C).	Adjust diluent temperature to 15 to 30°C.
The sampling nozzle is clogged and bubbles occur in the sub bath.	Replace the sampling nozzle with a new one.

Measurement

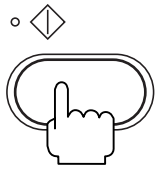
Count the diluent in closed mode and manual mode.

In Closed Mode



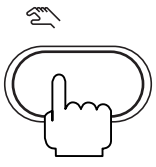
1. Press the Eject key on the front panel. The rack table slides out.

2. Set a few empty sample tubes in the rack.



3. Press the Start key on the front panel to count the empty samples.

In Manual Mode



1. Press the Manual mode key on the front panel. The sampling nozzle is lowered.

2. Press the Manual count switch to count the diluent. There is no need to aspirate the diluent from the sampling nozzle.

Results

The result is displayed on the screen after measurement. Make sure that the values are less than or equal to the following values.

WBC: 0.2 ($\times 10^3/\mu L$)
RBC: 0.05 ($\times 10^6/\mu L$)
HGB: 0.1 (g/dL)
PLT: 10 ($\times 10^3/\mu L$)
TOC: 100 (count)
(TOC: total optical count. This parameter only appears in a background noise measurement.)

Disregard the other parameter values because noise does not affect the other parameters.

If the values are greater than the above values, check the following items, press the Clean key to clean the fluid path and recount the diluent.

- The diluent is clean.
- No bubbles in the diluent.
- The apertures and aperture tubes are clean.
- The aperture is firmly attached.
- The measurement baths and sample cup are clean.

If the scattergram count is still over 100, refer to the “Background Noise” section.

Scattergram Check

Counting Blood Samples of a Healthy Person

1. Reduce the background noise so that the scattergram count (TOC) is less than or equal to 100.

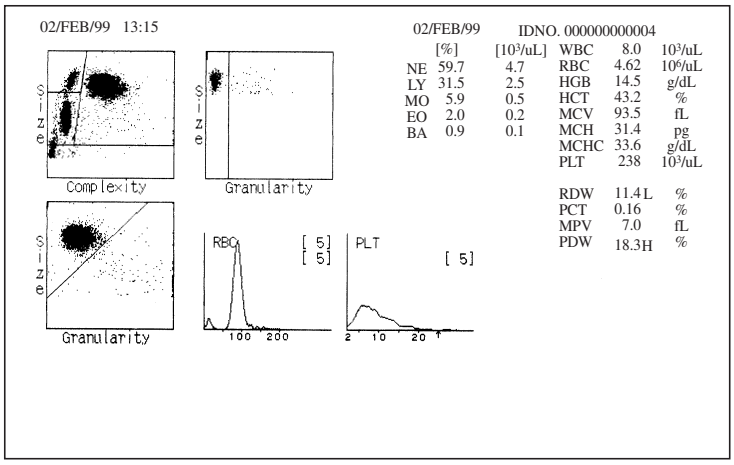
2. Prepare a blood sample of a healthy person. The blood sample must be within 8 hours after the blood sample is collected.

3. Turn the sample tube containing the blood sample upside down ten times or more so that the plasma and red blood cells are evenly mixed.

4. Set the sample tube containing the blood sample in the rack position no. 1.

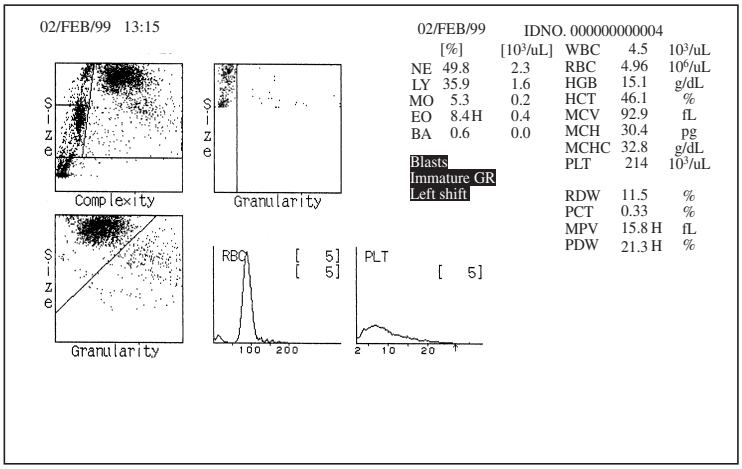
5. Press the Start key to count the blood sample.

6. Check that the 5 parts of WBC, i.e. neutrophil, lymphocyte, monocyte, eosinophil, and basophil are scattered on each allotted area as shown below. If a part of the 5-part WBC is scattered on an area different from the allotted area, refer to Section 6 “Adjustment”.

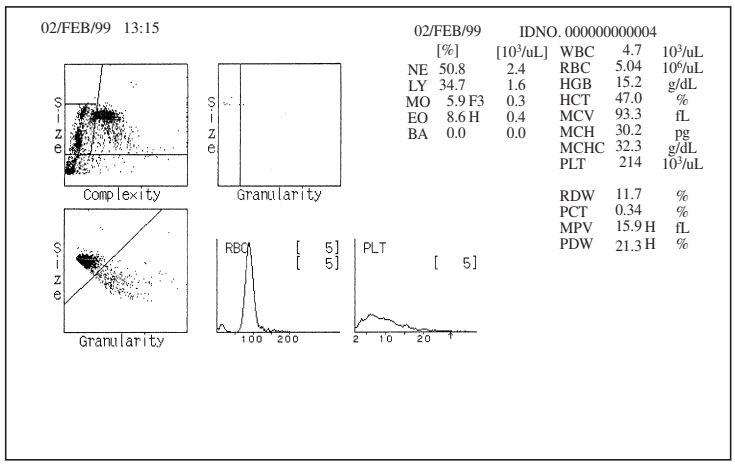


The following two cases require gain adjustment. Refer to Section 6 “Adjusting FS/FL/SD Gain and FS Threshold”.

1) Excessive high gain

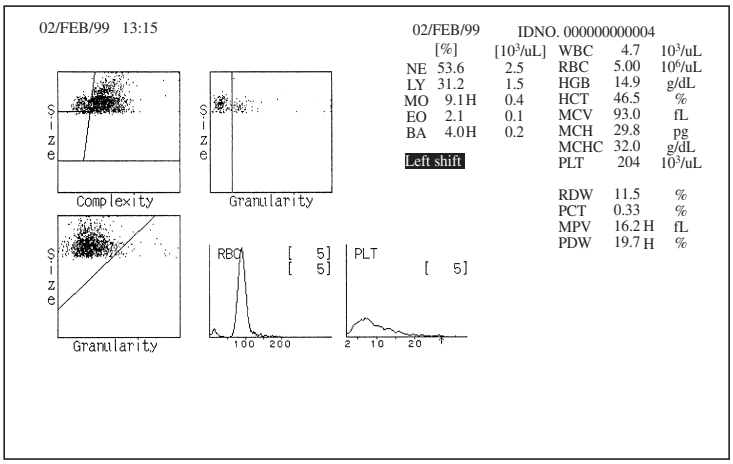


2) Excessive low gain

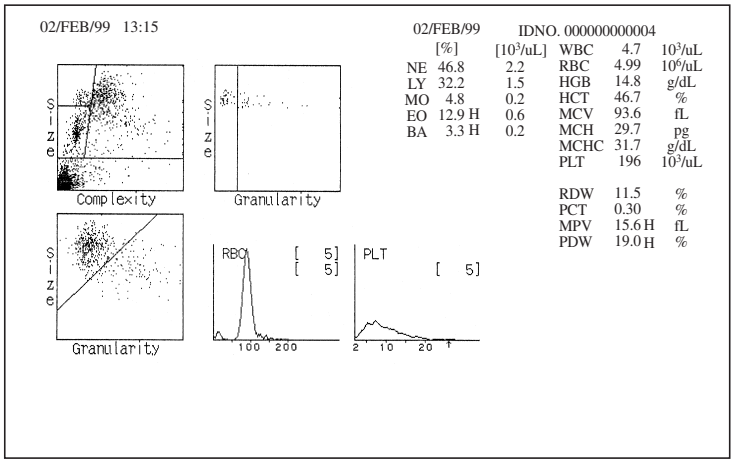


The following two cases require threshold gain adjustment. Refer to Section 6 “Adjusting FS/FL/SD Gain and FS Threshold”.

1) Excessive high threshold gain

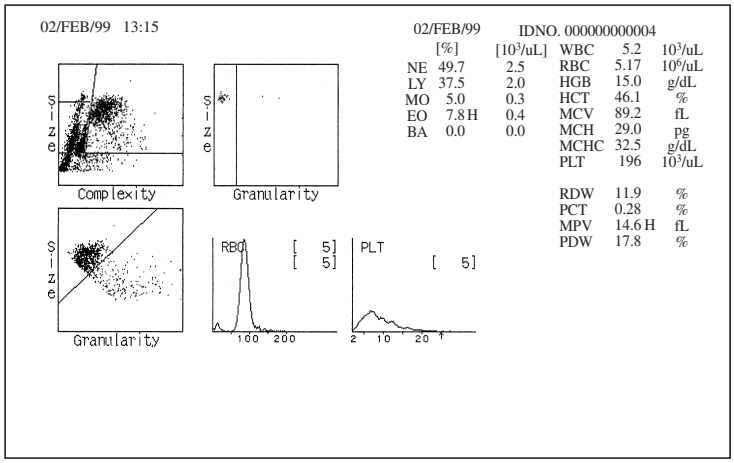


2) Excessive low threshold gain



The scattergram shown below results from one of the following reasons.

- The flow cell unit position is wrong or the flow cell is clogged.
- The blood sample has a problem.
- Problem such as leakage is somewhere in the fluid path.



The above scattergram requires adjustment or component replacement. Refer to “Scattergram Problems” section.

Reproducibility Check

Use blood sample of a healthy person for 10 measurements. The blood sample must be within 8 hours after the blood sample is collected so that you can check the data reproducibility with CV values. If the CV values are out of the specified range, the instrument does not work normally.
Refer to "Installation Flowchart" CLOSED 10 SAMPLES and 10 data X-CV on page 1.20.

Check Procedure

1. Reduce the background noise so that the scattergram count is less than or equal to 100. Refer to "Background Noise Check" on page 2.2.

2. Prepare blood sample of a healthy person. The blood sample must be within 8 hours after the blood samples are collected.

3. Turn the sample tube containing the blood sample upside down ten times or more so that the plasma and red blood cells are evenly mixed.

4. Set the sample tube containing the blood sample in tube stand No. 1.

5. Press the following keys on each screen to display the CLOSED 10 SAMPLES screen.

   MENU key → OTHER OPERATIONS key → SERVICE MAINTENANCE key → CONTINUOUS MEASUREMENT key → CLOSED 10 SAMPLES key

6. When the READY screen is displayed, press the following keys on each screen to display the 10 data X-CV screen.

   MENU key → OTHER OPERATIONS key → SERVICE MAINTENANCE key → 10 data X-CV key

7. Press the PRINT key on the screen to print the 10 data X-CV table.

8. Press the QUIT key on each screen until the MENU screen appears.

9. Press the DATA EDITING key on the MENU screen to display the DATA EDITING screen.

10. Delete the 10 sample data on tomorrow's date. Refer to the MEK-8222J/K operator's manual, Section 6 "DeletingData".

CV Data Check

Since the following parameters show you the data reproducibility of the instrument, check the printout data.

- CV of NE%: 5% or less (at NE% = 50%)
- CV of LY%: 5% or less (at LY% = 40%)
- CV of MO%: 12% or less (at MO% = 5%)
- CV of EO%: 20% or less (at EO% = 4%)
- CV of BA%: 40% or less (at BA% = 1%)

If the CV data of a parameter is higher than the above values, it means poor reproducibility of the parameter.

The data reproducibility statistically depends on the number of cells. If there are more of one type of cells, the CV is lower for the more numerous type of cells.

Since MO%, EO%, and BA% are much less than LY% and NE%, the CV for MO%, EO% and BA% is much higher than for LY% and NE%. Especially, BA% is less than 1% in a healthy person's blood. Therefore, the CV of BA% can reach up to 40%.

Check Items Before Instrument Check

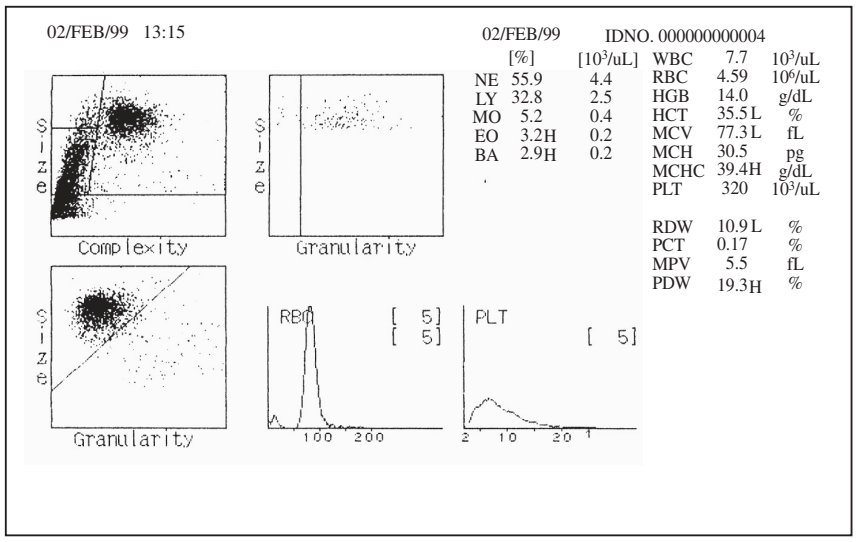
Check Items before Instrument Check

Use the instrument and diluent under the following operating conditions:

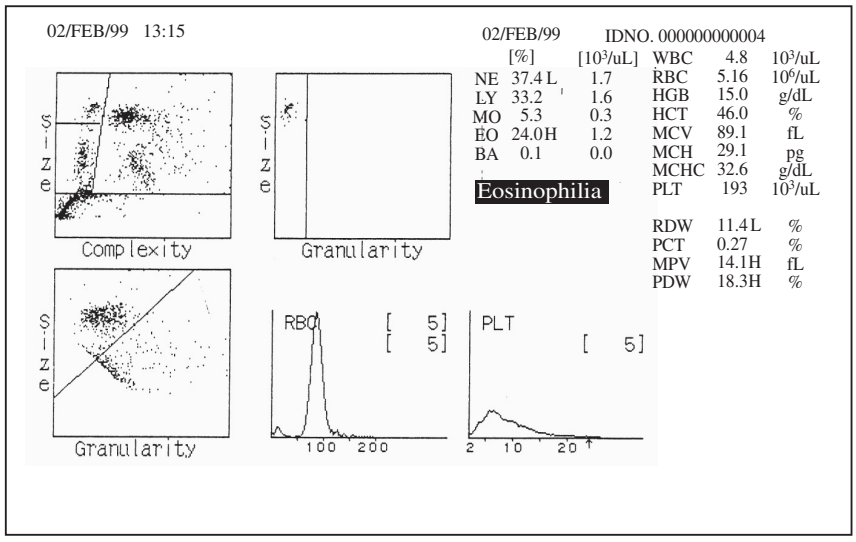
Around instrument	Diluent
- temperature: 15 to 30°C	- temperature: 15 to 30°C
- humidity: 30 to 90%	
- atmospheric pressure: 850 to 1060 hPa	

If the temperature is below 15°C, the WBC count may increase because the RBCs are not sufficiently hemolyzed due to the lower temperature. Insufficiently hemolyzed RBCs will be included in the WBC count as RBC ghosts.

When the sample, diluent, or hemolysing reagent temperature is lower than 15ºC, the scattergram has ghosts in the lymphocyte area.



When the sample, diluent, or hemolysing reagent temperature is higher than 30ºC, it will cause too many ghosts on the scattergrams. Too many ghosts will decrease the count of white blood cells. The 5 parts of the white blood cells are not clearly separated on the scattergrams. The percent of eosinophil may be higher than the normal temperature range.



Therefore, the room and fluid temperatures must be within the range of 15 to 30ºC.

Sampled Whole Blood Handling Check

Blood Sample Handling for Counting

To measure the white blood cells under stable conditions, leave blood samples under the temperature range of 15 to 30°C and count the blood samples within 8 hours after collecting them.

Blood Sample Handling for High Reliability

To get highly reliable data, do not count the blood samples which are left for more than 8 hours after the collection.
Counting the blood samples which are left for more than 8 hours may cause the 5 part ratios of the WBC to be out of the normal range even if the blood samples are collected from healthy persons.

Blood Sample from a Patient with Specific Conditions

There is a possibility that WBC counts are inaccurately obtained from patients with specific conditions. Especially, the red blood cells from a patient who has hepatopathy (liver disease), certain special treatment, or is neonatal have high resistance of their membranes against hemolysing reagent which causes insufficient hemolysing. This will cause a lot of ghosts within the WBC count areas so that the ghosts can be counted as WBC. It requires a measurement method other than the hematology analyzer, such as the smear method.

Incorrect Data

Background Noise

When the obtained diluent data just exceeds the tolerable value of the parameter shown in the table in "Background Noise Check" of this section, there are five possible causes of error:

(1) Dirty diluent
(2) Dirty fluid paths in the instrument

NOTE

Before storing the instrument for a long time, clean all fluid paths in the instrument with distilled water. Otherwise, the diluent salt adheres to the baths and cannot be removed easily.

(3) Dust which adheres to the flow cell wall causes the laser beam to widely diverge and scatter.
(4) Electrical noise affecting the counting/calculation circuit:
AC line, peripheral equipment such as microwave treatment machine, motors in the instrument.
(5) Mechanical noise affecting the counting/calculation circuit:
Vibration from motors in or around the instrument, such as a centrifuge.

As a countermeasure to the above 5 causes, take the following actions.

Cause (1): Replace the 18 L diluent container with a new one.

Cause (2): Press the Clean key 2 or 3 times.

Cause (3): Gently clean the flow cell wall with a cotton swab moistened with alcohol and leave it to dry.

CAUTION

Never scratch the flow cell wall.

Cause (4): Securely ground the instrument, including any optional units such as a card printer.

Cause (5): Keep the instrument away from the vibration source.

How to Decrease the Background Noise on the Instrument after Long Term Storage

If the instrument is left for a long time without diluent draining, the diluent in the measurement bath evaporates. The salt crystals remain and adhere to the mixing chamber, sampling cup and other fluid paths. The salt crystals cannot be removed with normal cleaning.

High background noise results from storing the instrument without cleaning it. Even an instrument cleaned with distilled water has dust which is very difficult to remove after long term storage.

To decrease the background noise on the instrument, perform the following procedure.

1. Clean the sampling cup with the CLEANAC•3 detergent. Refer to Section 10 “Maintenance” of the operator’s manual.

2. Check the filters. Refer to Section 10 “Maintenance” of the operator’s manual.

3. Check the pump tube and pinch valve tubes. Refer to Section 10 “Maintenance” of the operator’s manual.

4. Press the Clean key on the front panel to clean the inside of the instruments.

5. Set a few empty sample tubes in the rack and perform the background noise check to check if the background noise on specified parameters are within the respective normal ranges.

NOTE

If the background noise is still out of the range, repeat the above procedure.

Laser Optical Unit Problems

Problem 1.

Scattergram and Histograms do not appear. The TOC (total optical count) is 0.

Possible Cause	Countermeasure
The LASER switch is set to off.	Remove the cause.
Failure of MP-822V. No flow of the sheath fluid.	Replace the MP-822V with a new one.
Failure of MP-821V. No flow of the sample.	Replace the MP-821V with a new one.
Wrong position of the MF-820V.	Adjust the flow cell position.

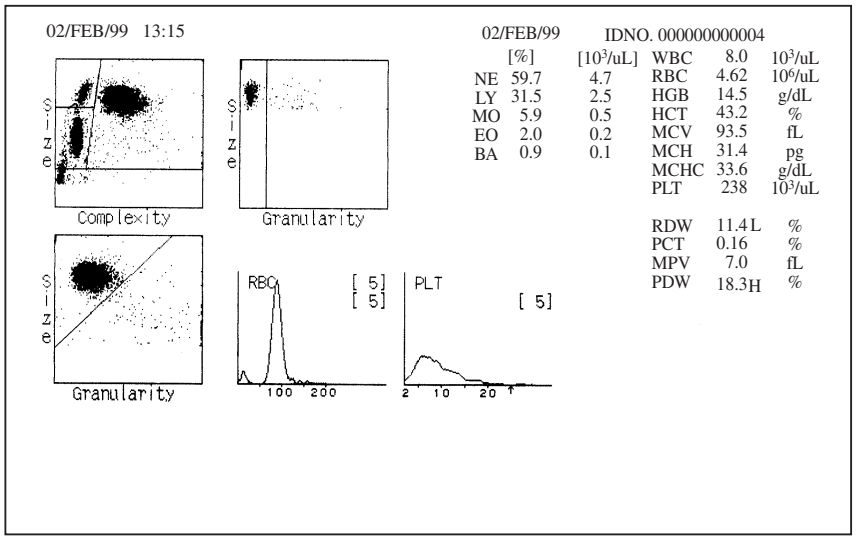
Problem 2.

CV of FS and FL is above 7.0%.

Possible Cause	Countermeasure
Wrong position of the MF-820V.	Adjust the flow cell position.
Inside of the flow cell is dirty. There are bubbles in the flow cell.	Perform the CLEAN FLOW CELL procedure.
7 µm polymer microsphere suspensions are wrong. (For example, it is too old.)	Change 7 µm polymer microsphere suspensions.
Sheath pressure gives excessively high or low pressure. 95 to 105 kPa is acceptable.	Replace the MP-822V with a new one.
The flow cell is clogged.	Remove the cause.
Dust is adhered to the flow cell outside wall.	Clean the outside wall of the flow cell with a cotton swab moistened with alcohol.

Scattergram Problems

When the instrument works normally, it displays a normal scattergram such as the following typical one after aspirating the healthy person's blood.

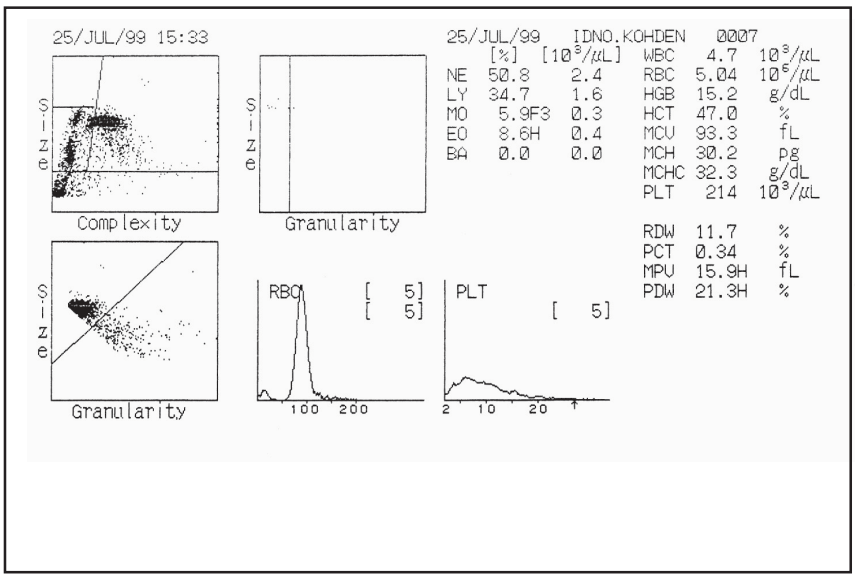


If a scattergram different from the above example is displayed, there are a lot of possible causes as shown below.

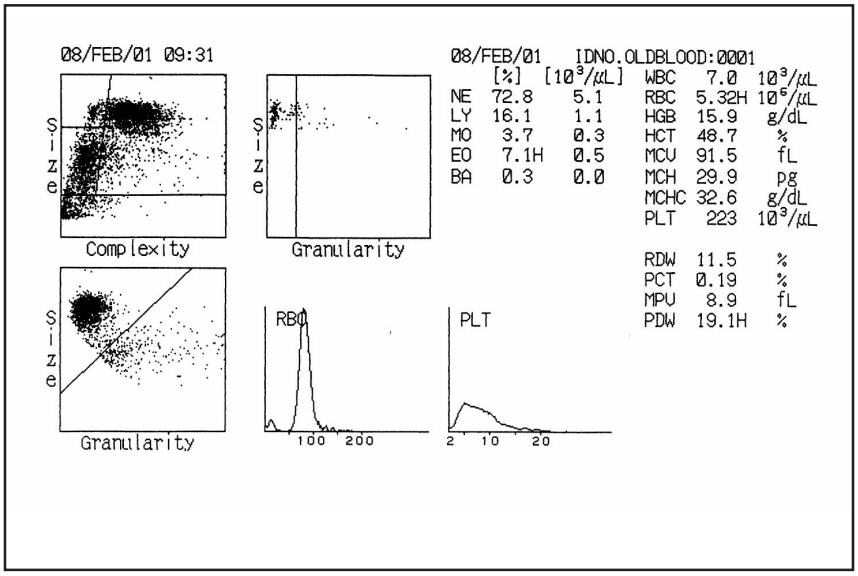
- **Scattergram 1**

  The following example shows that the 5 parts of WBC are grouped but they are not in the area allotted by the division lines.

	Possible Causes	Countermeasure
1	Gain of the amplifier which amplifies the scattered light pulses is set incorrectly. See Fig. 1.	Adjust the gain correctly. Refer to Section 6 "Adjusting FS/FL/SD Gain and FS Threshold".
2	The inside wall of the flow cell is dirty. Albumin adhered to the inside wall of the flow cell can decrease the scattered light intensity. See Fig. 1.	Press the Clean key to clean the wall inside the flow cell.
3	The blood sample collected from a person is left for more than 8 hours. It can cause hemolyzed WBC. See Fig. 2.	Use the blood sample within 8 hours after collecting the blood sample.
4	Even if the blood sample is collected from a healthy person, the scattergram may show a pattern different from normal because of specific blood characteristics. See Fig. 3.	Not required because there is no problem.
5	Laser beam intensity decreases without the above causes 1 and 2. The wrong setting of the laser beam focus or deterioration of the semiconductor laser can cause each part of the WBC to not be in the allotted area and each cell size to be in a lower position than the actual WBC. See Fig. 1.	Replace the MO-820V laser optical unit with a new one.
6	If the flow cell is set to a wrong position so that the center of the flow cell is slightly out of alignment with the laser beam axis, the scattergram may show that each cell size is in a lower position than the actual WBC because the wrong position of the flow cell decreases the scattered light intensity. See Fig. 1.	Adjust the flow cell position. Refer to Section 6 "Adjusting the Flow Cell Position".

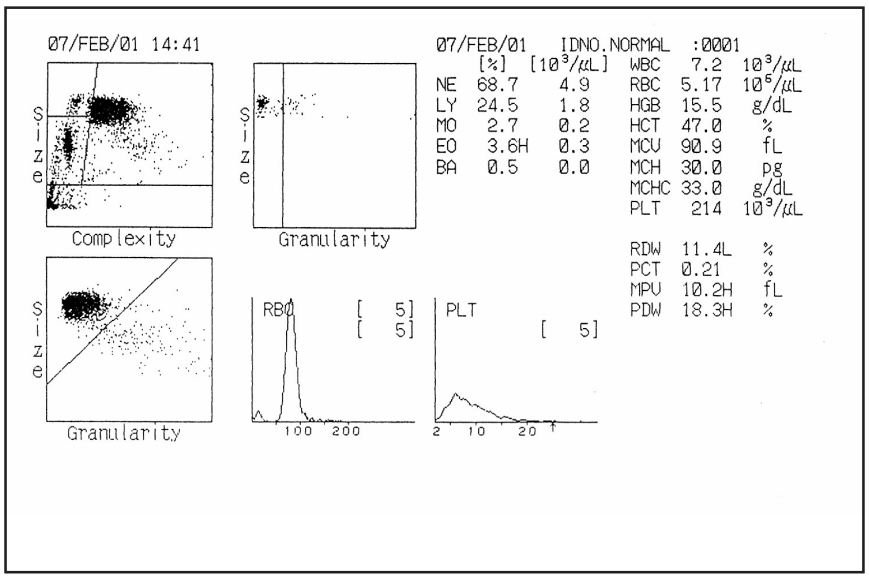


<Fig. 1>



<Fig. 2>

When the blood sample is left for more than 12 hours after the collection, the 5 parts of white blood cells have not been clearly separated.

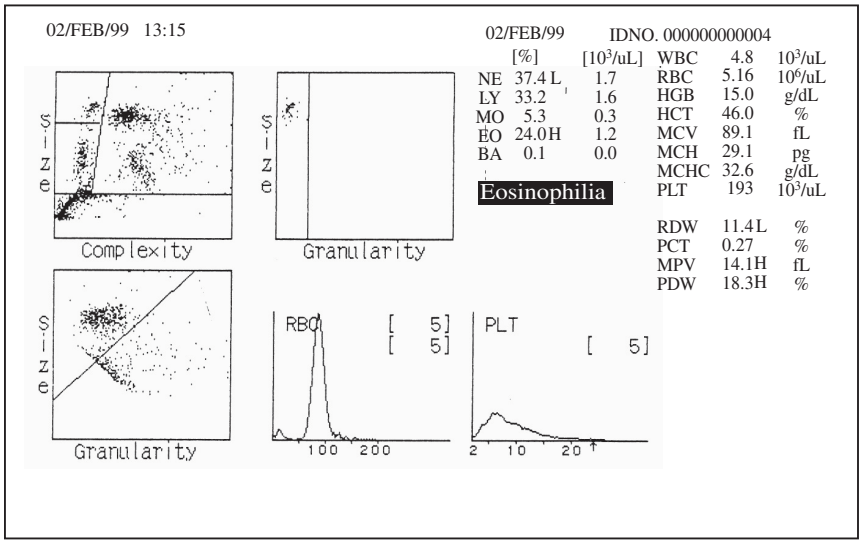


<Fig. 3>

The edge of neutrophil distribution is in the MO & BA area on the Size-Complexity scattergram because of specific blood characteristics.
It is not caused by a wrong setting or malfunction of the instrument.

- **Scattergram 2**

The following example shows that the 5 parts of WBC are not clearly separated because of too many ghosts. Too many ghosts will decrease the WBC count and stay at the NE & EO area so that the EO percentage may be excessively higher.

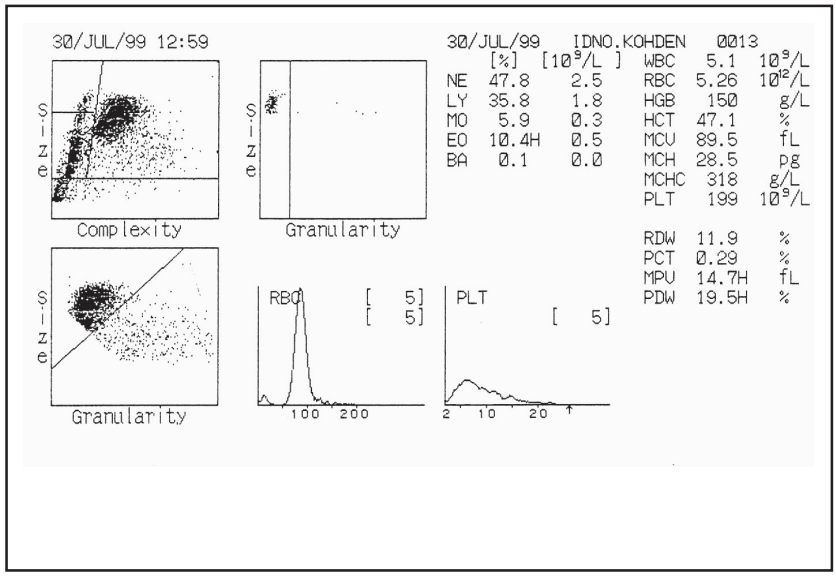


<Fig. 4>

	Possible Causes	Countermeasure
1	Even if the blood sample is collected from a healthy person, the scattergram may show that there are a lot of ghosts because of specific blood characteristics.	Not required if the ghosts are scattered out of the scattergrams. There is a possibility that WBC counts are inaccurately obtained from a patient with specific conditions. Especially, the red blood cells from a patient who has hepatopathy, certain special treatment, or is neonatal with high resistance of their membranes against hemolysing reagent, will have insufficient hemolysing. This will cause too many ghosts on the scattergrams. It requires a measurement method other than the hematology analyzer, such as the smear method.
2	The operating temperature is out of 15 to 30°C.	Use the instrument within the range of 15 to 30°C according to the specifications.
3	If aspirating the blood sample takes a longer time than the usual aspiration time or stirring the blood sample in the mixing chamber is insufficient, hemolysing the RBC insufficiently can result in a lot of ghosts. The possible causes are shown below. - Clog in filter. - Deterioration of pump tube at rotary pump unit MP-520V. - Loose tube joint. - Clog at sampling cup. - Leak at mixing chamber, especially at joint. - Leak in fluid path.	Remove the cause.
4	The lyse pump unit has one of the following problems. - The hemolysing reagent is not dispensed correctly because of abnormal position sensor. - The hemolysing reagent is not aspirated nor dispensed correctly because of an abnormal valve. - The hemolysing reagent leaks because of an abnormal O-ring, piston, or cylinder.	Remove the cause.

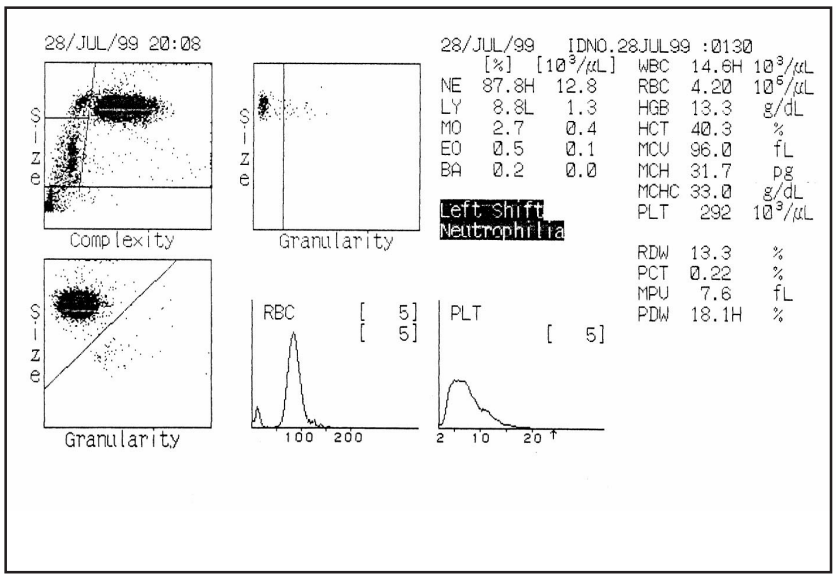
- **Scattergram 3**

  The following example shows that the 5 parts of WBC are too widely scattered to group them.



<Fig. 5>

	Possible Causes	Countermeasure
1	The blood sample is from a person who has a specific blood characteristic. The blood sample is from a person who has too many WBC to group normally. See Fig. 6.	These causes do not result in incorrect data.
2	Wrong position of the flow cell unit. If the blood cell which flows in the flow cell does not meet the center of the laser beam, the scattered light intensity varies according to the blood cell position in the flow so that each part of the WBC cannot be clearly grouped. See Fig. 5.	Adjust the flow cell position optimally. Refer to Section 6 "Adjusting the Flow Cell Position".
3	Turbulent flow of the sheath (diluent) and diluted blood sample in the flow cell. Adjust the flow cell position by counting 7 µm polymer microsphere suspensions according to Section 6 "Adjustment". If one of the FS and FL coefficients of variation is still more than 7.0% after the flow cell position adjustment, one of the following causes will make turbulent flow in the flow cell. - The instrument is used where there is vibration. - There is a leak in the fluid path or a tube is folded. - There is foreign matter such as dust in the flow cell. - There are bubbles in the flow cell. - The straightening part of the flow cells is clogged by contamination. - Dust or contamination clogs somewhere in the fluid path. - Foreign matter such as dust is adhered to the flow cell outside wall. - Foreign matter such as dust is adhered to the lens. - Foreign matter such as dust is adhered to the detector. - MO-820V has one of the following problems. Laser beam is thinner than the normal. Laser beam axis is not aligned with the detector. - MP-822V has the following problem. Since the sheath pump gives excessive high pressure, the sheath flow is turbulent. If the sheath pump gives excessive low pressure, the WBC cannot be kept in single file at the flow cell. See Fig. 5.	Remove the causes. - Refer to operator's manual Section 10 "Cleaning the Flow Cell". - Refer to operator's manual Section 10 "Cleaning the Flow Cell". - Replace the MO-820V with a new one. - Adjust the secondary pressure to 95 to 105 kPa using the regulator.



<Fig. 6>

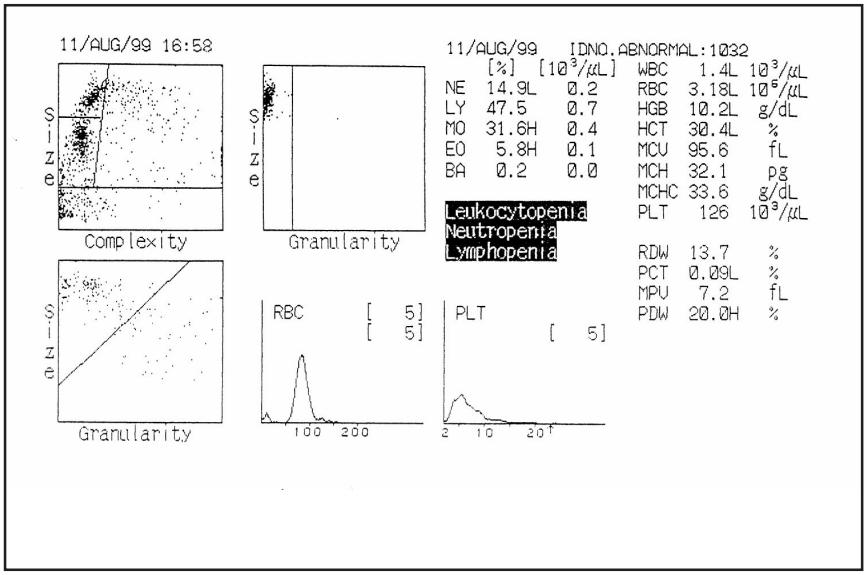
Since the blood has too many WBC and NE, the NE is widely scattered on the Size-Complexity scattergram.

- **Scattergram 4**

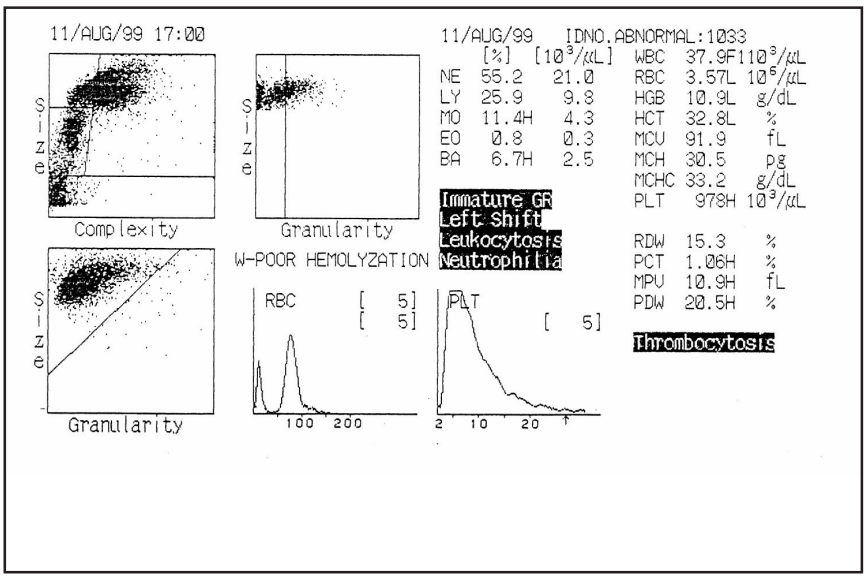
  The following example shows that the 5 parts of WBC are quite differently scattered from the normal one or not displayed at all.

	Possible Causes	Countermeasure
1	Specific blood characteristics - When there are too many ghosts for the instrument to count the WBC, the scattergram shows only the ghosts. High membrane resistance of the red blood cells collected from the patient who has a disease such as liver disease or has red blood cells resistant to hemolyzation allows such a scattergram. See Fig. 13. - The blood sample of a leukemia patient has no normal scattergram. See Fig. 7A, 7B.	Perform a measurement method, such as the smear method, instead of using the hematology analyzer.
2	Wrong gain setting for the scattered light pulse. If the amplifier gain for scattered light is set excessively high or low, most of the white blood cells are shown at the end of the scattergram. See Fig. 8.	Adjust the amplifier gain optimally. Refer to Section 6 "Adjusting FS/FL/SD Gain and FS Threshold".
3	Wrong reagent use If a diluent other than ISOTONAC•3 or a hemolysing reagent other than HEMOLYNAC•5 is used, the scattergram has no data reliability.	Use Nihon Kohden specified reagents.
4	Use of MEK-3DN Using the MEK-3DN does not allow the data reliability on the scattergram. See Fig. 9.	Not required.
5	Failure of diluent or blood sample aspiration. See Fig. 10. The following problems can cause such a scattergram. - The filter is clogged. - The pump tube at MP-520V is broken. - A tube joint is loose. - The sampling cup outlet is clogged. - There is a leak at the mixing chamber. - A tube in the fluid path has a leak.	Remove the cause.
6	Failure of sample transfer to the flow cell unit from the mixing chamber. See Fig. 11. The following problems can cause such a scattergram. - The waste fluid tube is collapsed or clogged by dust or contamination. - The flow cell is clogged by contamination. - The sample needle is clogged at the straightening part in the flow cell. - The MP-821V does not work. - The silicon tube is not completely inserted into the bottom of the sample needle under the flow cell or the silicon tube is folded.	Remove the cause.
7	Failure of flow cell unit MF-820V. See Fig. 12. The following problems can cause such a scattergram. - The flow cell is broken. - The flow cell is clogged by contamination or dust. - The straightening part of the flow cell has a leak or clog. - Foreign matter such as dust is adhered to the flow cell outside wall.	Remove the cause. - Replace the flow cell unit with a new one.
8	Failure of MP-821V sample pump unit. See Fig. 11. The following problems can cause the failure that the pump does not work. - The piston position sensor (photo-interrupter) is broken. - The piston rod coupler screw is loose. - There is a poor contact between the connectors or the cable is disconnected. The following problems can cause the failure that the pump works but the blood sample is not transferred. - The electromagnetic valve is broken (leak, wire disconnection, poor contact). - The piston O-ring has deterioration. - Tube joints at the electromagnetic valve are loose. - Leak at the end of the tube.	Remove the cause.

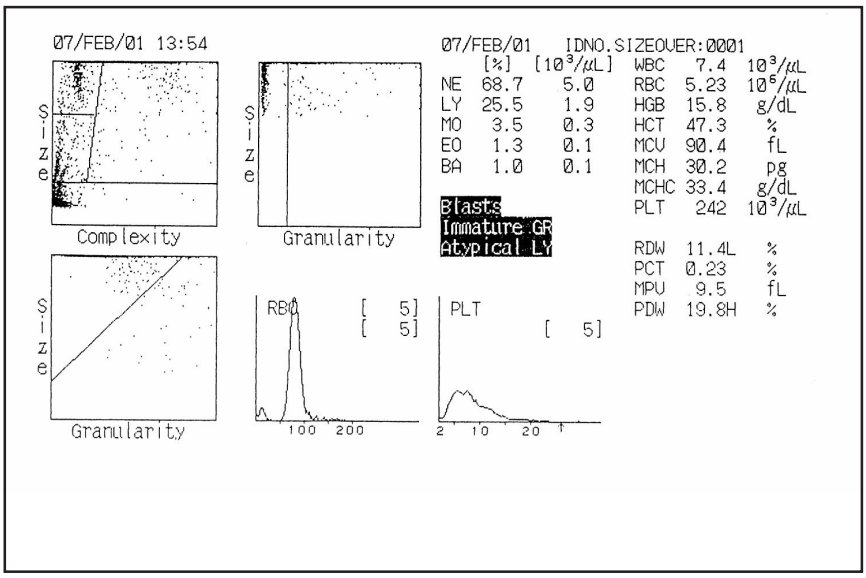
	Possible Causes	Countermeasure
9	Failure of MP-820V. See Fig. 13. The following problems can cause the display of too many ghosts on the scattergram. - Faulty piston position sensor does not allow the hemolysing pump to dispense the correct volume. - Faulty electromagnetic valve does not allow the hemolysing pump to aspirate or dispense the correct volume. - Faulty O-ring, faulty piston or faulty cylinder allows the hemolysing reagent to leak.	Remove the cause.
10	MP-822V failure. No flow of the sheath fluid (diluent). See Fig. 14. The following problems can cause such a scattergram. - Poor contact at the connector or disconnection of the cable. - A leak in the fluid path or tube disconnection. - A leak in the air tank. - Faulty regulator. - Faulty electromagnetic valve. - Tube joint is loose at the electromagnetic valve.	Remove the cause.
	No fluid is in the air filter.	Remove the cause.
11	No display on the scattergram. See Fig. 12. - The LASER switch on the left side of the instrument is set to OFF. - The head cover if open. - A faulty PREAMP board (especially FS PREAMP board). - Faulty 5 DIFF board. - Wrong position of the MF-820V.	Remove the cause. - Adjust the flow cell position. Refer to Section 6 “Adjusting the Flow Cell Position”.



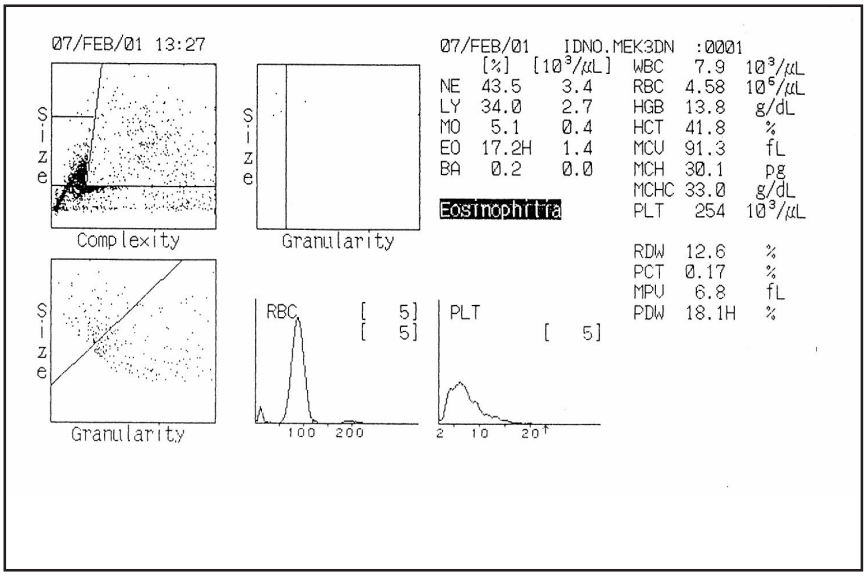
<Fig. 7A>



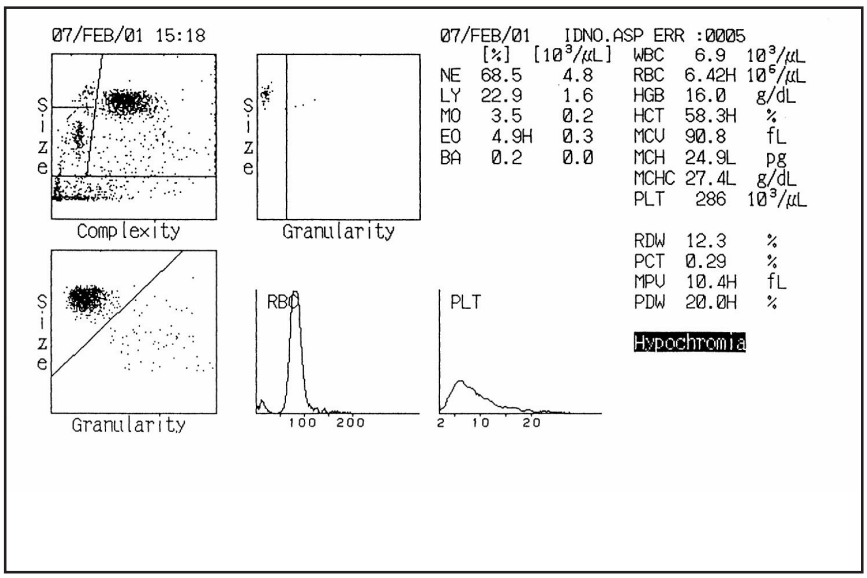
<Fig. 7B>



<Fig. 8>

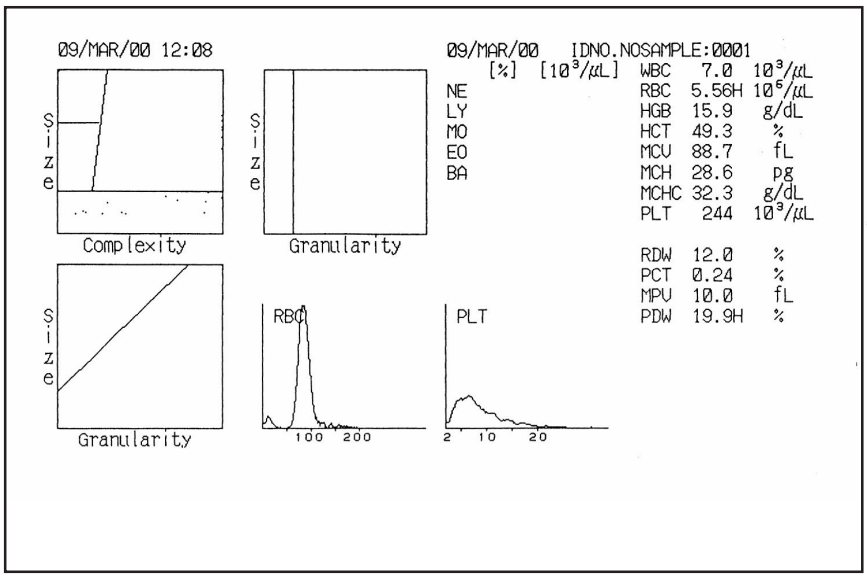


<Fig. 9>

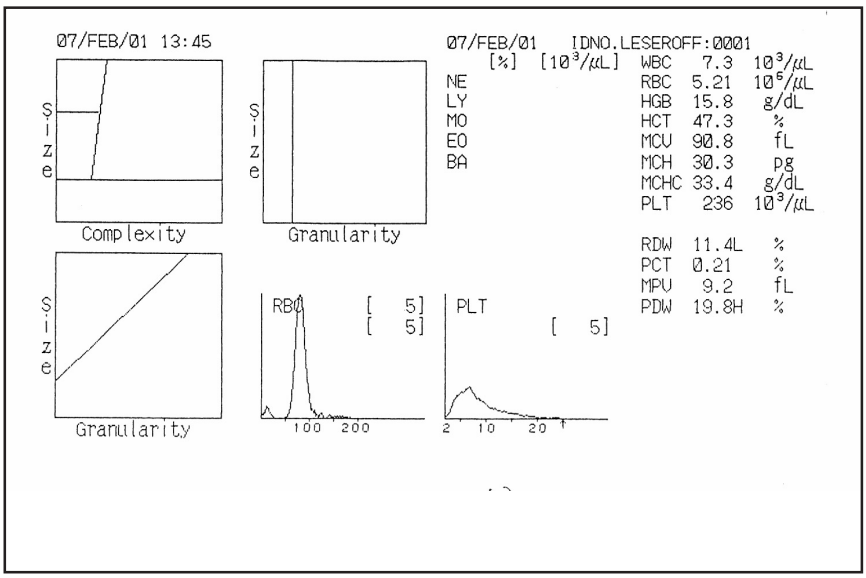


<Fig. 10>

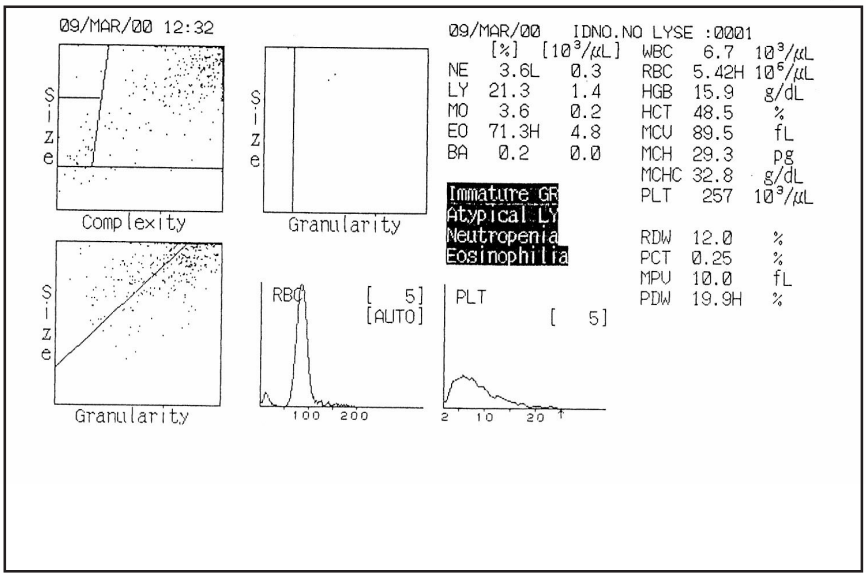
Failure of diluent or blood sample aspiration causes the overflow of the diluent or blood from the sampling cup to go in the RBC measurement bath. It makes the RBC, HCT, and PLT higher and displays abnormal erythrocyte index message flag such as Hypochromia.



<Fig. 11>

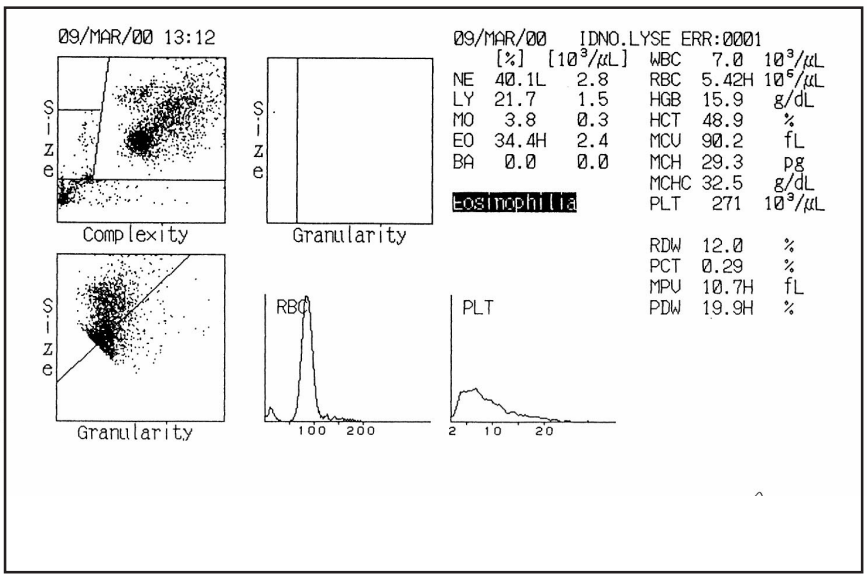


<Fig. 12>



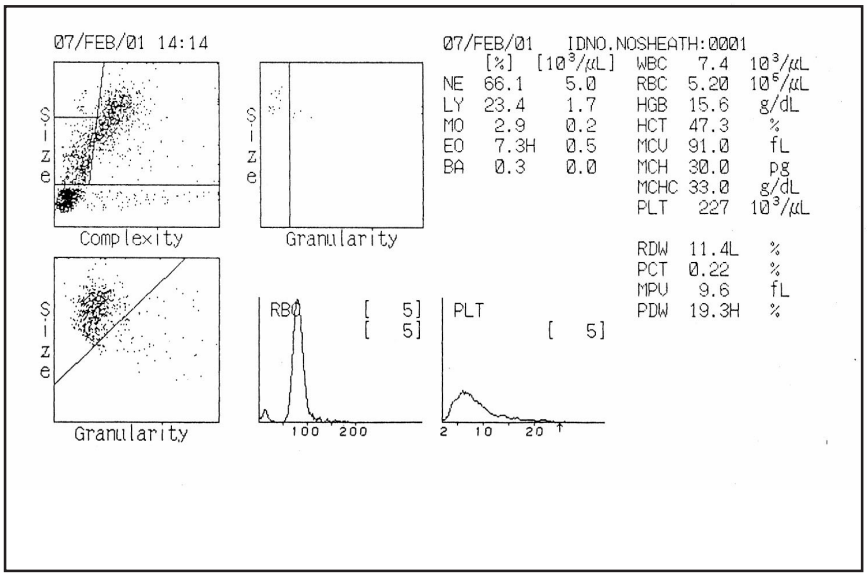
<Fig. 13A>

High membrane resistance of the red blood cells collected from the patient who has a disease, such as liver disease or has red blood cells resistance to hemolyzation, allows such a scattergram. As another case, since there is no hemolysing reagent in the mix chamber due to the failure of the hemolysing pump, the data is scattered around the upper right corner on the scattergrams. Then some message flags such as Immature GR will be displayed.



<Fig. 13B>

High membrane resistance of the red blood cells collected from the patient who has a disease, such as liver disease or has red blood cells resistance to hemolyzation, allows such a scattergram. As another case, since there is insufficient hemolysing reagent in the mix chamber due to the failure of the hemolysing pump, the scattergram shows few data and many ghosts which have been counted as EO.



<Fig. 14>

Possible Causes and Countermeasures for Poor WBC Reproducibility

If you get a poor reproducibility result even though each scattergram has no problem after performing the "Reproducibility Check" section, consider the following reasons and take the countermeasure to solve the reproducibility problem.

1) Deterioration of blood sample
   Since the blood sample is left for more than 12 hours after being collected, the 5 part WBC counts can cause a poor reproducibility.
   Countermeasure: Use the blood sample within 12 hours after collecting it.
2) Use of blood sample of which the WBC is less than normal
   If the blood sample collected from a healthy person has a lower than normal quantity of WBC, it can cause poor reproducibility. The data reproducibility statistically depends on the quantities of each cell. If there are more of one type cells than other type cells, the CV is lower than for the other type cells. If the CV data of a parameter is higher than the CV value on the specifications, it means poor reproducibility of the parameter.
   Countermeasure: Use a blood sample of healthy person.
   Use CV compensated according to the WBC quantity.
3) Use of unspecified reagents
   Using a reagent different from the specified one can cause poor reproducibility.
   Countermeasure: Use only the specified reagents.
4) Faulty MP-821V
   If there is a leak or a bubble in the MP-821V, it can cause poor reproducibility because the diluted blood sample does not flow normally and the WBC quantity decreases.
   Countermeasure: Remove the leak or bubble from the MP-821V.
5) Wrongly diluted blood sample
   If the diluent is left in the sampling cup or mixing chamber, the blood sample is more diluted. It can cause poor reproducibility. If the waste fluid flows backward and is left in the mixing chamber during the aeration for mixing the blood sample with hemolysing reagent, it can cause poor reproducibility.
   Countermeasure: Remove the leak or clog which causes the remaining diluent or backward waste flow.
6) Noise
   External noise comes in, the noise can be counted as white blood cells and will cause poor reproducibility.
   Countermeasure: Remove the cause of the noise.

Troubleshooting an Alarm

Reagent Alarm

The instrument generates the following alarms as reagent alarms when the 4 channel liquid detection sensors in the Inlet/Outlet unit cannot detect the presence of diluent, detergent, and hemolysing reagents.

NO DILUENT
NO DETERGENT
NO LYSING REAGENT

1) NO DILUENT

Possible Causes		Countermeasure
When the diluent cannot be aspirated through the ISOTONAC•3 diluent inlet.	Damage in the diluent aspiration fluid path or loose tube joint.	Check the fluid path.
	Faulty mixing chamber.	Replace the mixing chamber.
	The tube is disconnected or the tube has a leak.	Completely connect the tube between the instrument and ISOTONAC•3 container or replace the tube with a new one.
	The pump tube for MP-520V has a deterioration or leak.	Replace the pump tube with a new one.
When the diluent can be aspirated through the ISOTONAC•3 diluent inlet.	Air bubbles stay on the liquid detector sensor.	Press the Clean key on the front panel.
	Wrong setting of the sensor voltage.	Adjust the VR on the Liquid Sensor board.
	Faulty liquid detection sensor.	Replace the Liquid Sensor board.

2) NO DETERGENT

Possible Causes		Countermeasure
When the detergent cannot be aspirated through the CLEANAC or CLEANAC•3 detergent inlet.	Damage in the detergent aspiration fluid path or loose tube joint.	Check the fluid path.
	Faulty mixing chamber.	Replace the mixing chamber.
	One of the tubes is disconnected or the tube has a leak.	Completely connect the tube between the instrument and CLEANAC•3 container or replace the tube with a new one.
		Completely connect the tube between the instrument and CLEANAC container or replace the tube with a new one.
	The pump tube for MP-520V has a deterioration or leak.	Replace the pump tube with a new one.
When the detergent can be aspirated through the CLEANAC or CLEANAC•3 detergent inlet.	Air bubbles stay on the liquid detector sensor.	Press the Clean key on the front panel.
	Wrong setting of the sensor voltage.	Adjust the VR on the Liquid Sensor board.
	Faulty liquid detection sensor.	Replace the Liquid Sensor board.

3) NO LYSING REAGENT

Possible Causes		Countermeasure
When the hemolysing reagent cannot be aspirated through the HEMOLYNAC•5 inlet.	Faulty 3-way valve of the hemolysing pump	Replace the 2-way valve.
	Faulty cylinder block of the hemolysing pump	Replace the cylinder block.
	Faulty O-ring of the hemolysing pump	Replace the O-ring.
	Damage in the hemolysing reagent aspiration fluid path or loose tube joint.	Check the fluid path.
	The tube is disconnected or the tube has a leak.	Completely connect the tube between the instrument and HEMOLYNAC•5 container or replace the tube with a new one.
When the hemolysing reagent can be aspirated through the HEMOLYNAC•5 inlet.	Wrong setting of the sensor voltage	Adjust the VR on the Liquid Sensor board.
	Faulty liquid detection sensor	Replace the Liquid Sensor board.

Section 3 Board/Unit Description

Sub Bath Unit 3.1
CBC Measuring Unit 3.1
Laser Optical Unit 3.1
Complex Pump Unit 3.1
Sample Pump Unit 3.2
Sheath Pump Unit 3.2
Closed Sampler Unit 3.2
Open Sampler Unit 3.2
Table Unit 3.2
Display Unit 3.2
MASTER Board 3.3
SLAVE CBC Board 3.3
SLAVE MS Board 3.3

The instrument consists of the following units and boards.

Sub Bath Unit

The sub bath unit has two sub baths and motors which rotate the sub baths. The two sub baths are used for 200 times for WBC/HGB and 40,000 times for RBC/PLT diluted samples, respectively. The diluted sample in each sub bath is poured into the measurement bath of the CBC measuring unit when the sub bath is rotated.

CBC Measuring Unit

The measuring unit has two measurement baths and manometers. Each measurement bath has an aperture. The aperture size is different for the two baths (WBC and RBC/PLT). Two electrodes are positioned so that the aperture is in between them. When a constant current flows between the two electrodes and blood cells are passing through the aperture, the voltage between the two electrodes varies in proportion to the cell size (electrical resistance). The voltage variation signals, such as pulses for passing cells, are obtained until the constant volume of diluted sample is aspirated. A voltage which is proportional to the hemoglobin concentration is also obtained. These data are sent to the SLAVE CBC board.

Laser Optical Unit

The laser optical unit emits a laser beam that is applied to each blood cell in the diluted and hemolysed sample which passes through the flow cell in a single file. The cells reflect and scatter the laser according to their size and shape. The scattered light is collected in three directions, i.e. forward small angle scattered light component (FS), forward large angle scattered light component (FL) and orthogonal scattered light component (SD). These collected light intensities are converted to electrical signals and amplified on the PRE AMP board.

Complex Pump Unit

The complex pump unit aspirates a whole blood sample and dilutes it 200 times and 40,000 times. This unit dispenses the constant volumes of the diluent and hemolysing reagent.

Sample Pump Unit

The sample pump unit aspirates the diluent and dispenses it. This unit sends the diluted and hemolysed sample to the flow cell at 3 to 6 µl/second.

Sheath Pump Unit

The sheath pump unit applies the constant pressure to the diluent and sends it to the flow cell.

Closed Sampler Unit

The closed sampler unit releases a pressure inside the sample tube with the cap pierce nozzle. The unit aspirates the sample in the tube and moves the sampling nozzle to the sub bath or sampling cup so that the aspirated sample is ready for the measurement. After the sample is aspirated, the rinse unit cleans blood from the outside of the sampling nozzle.

Open Sampler Unit

The open sampler unit moves the manual sampling nozzle to the sub bath or measurement bath so that the aspirated sample is ready for the measurement. After the sample is aspirated, the manual rinse unit cleans blood from the outside of the sampling nozzle.

Table Unit

The table unit moves a sample tube set in the rack to the stirring position or blood aspiration position using x-axis and y-axis drive motors.

Display Unit

The display unit displays the numeric and graphic data and operation keys on the color LCD screen. This unit controls the LED indicators for the status of the switches on the front panel.

MASTER Board

The MASTER board controls the operations for the measurement with flow cytometry method and performs the data processing for the user interface as shown below.

- Control of the electromagnetic valves and motors
- Amplification and count of the pulses obtained from the scattered light
- LCD control
- USB control
- Memory card control

SLAVE CBC Board

The SLAVE CBC board controls the following operations for dilution and blood cell count with the electrical resistance detection method.

- Control of the electromagnetic valves and motors
- Amplification and count of the pulses obtained from the electrical resistance detection
- Dilution control

SLAVE MS Board

The SLAVE MS board controls sample transportation, stirring and dispensing such as control of the electromagnetic valves and motors.

Section 4 Disassembly and Assembly

Removing the PV-820V Display Unit 4.1
Removing the MC-820V CBC Measuring Unit 4.2
Removing the MB-820V Sub Bath Unit 4.4
Removing the MP-820V Complex Pump Unit 4.5
Removing the MS-820V Closed Sampler Unit 4.6
Removing the MS-821V Open Sampler Unit 4.7
Removing the MS-822V Table Unit 4.8
Removing the MO-820V Laser Optical Unit 4.9
Removing the MP-821V Sample Pump Unit 4.10
Removing the MP-822V Sheath Pump Unit 4.11
Removing the MC-821V Flow Cytometry Piping Unit 4.12
Removing the MP-520V Pump Unit 4.14

Before disassembling the instrument according to the following procedures, remove the front, top, side and rear covers from the instrument.

Removing the PV-820V Display Unit

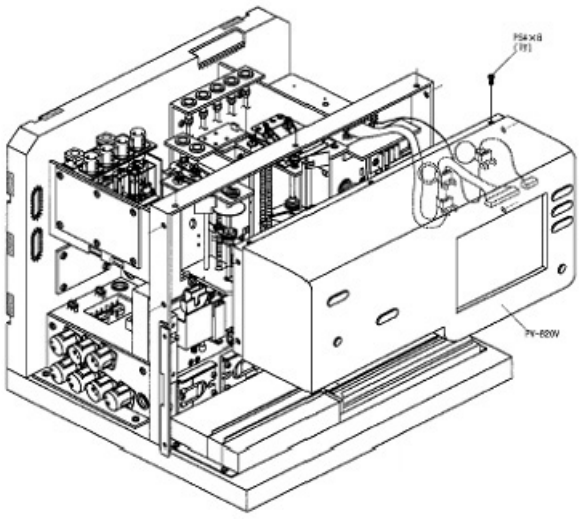
The display unit consists of the following.

- Color TFT LCD
- Touch screen
- RACK KEY board
- MANUAL KEY board
- LCD CONTROL board

1. Remove the 7 screws which secure the display unit to the chassis.

2. Slightly push the display unit toward the rear and unhook its inside hook. Slowly remove the display unit from the instrument until you can disconnect the 2 cables connected to the MASTER board at the LCD CONTROL board.

3. Remove the 3 ferrite cores from the display unit by pressing both hooks of each ferrite core inward. Disconnect the 2 cables from the display unit and completely remove it from the instrument.



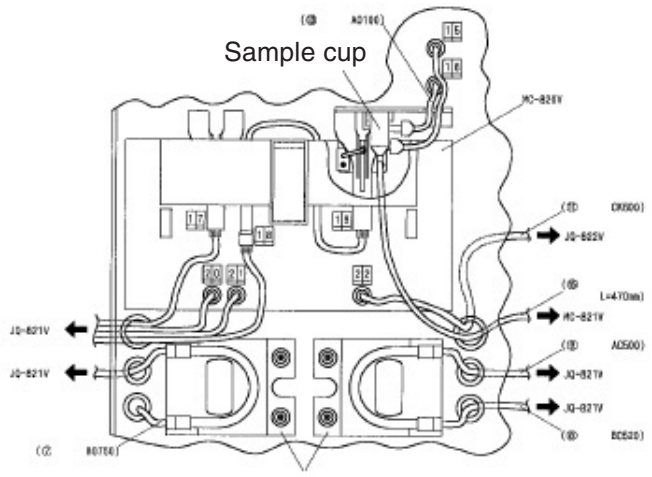
Front view

Removing the MC-820V CBC Measuring Unit

The CBC measuring unit consists of the following.

- Two apertures (80 µm in diameter for RBC, 100 µm in diameter for WBC)
- PRE AMP board
- Two manometers and MANOMETER boards for RBC/PLT and WBC
- HGB measuring block
- HGB AMP board
- HGB LED board
- Two measurement baths
- Electromagnetic (solenoid) valves
- Air chamber
- Manual measurement switch

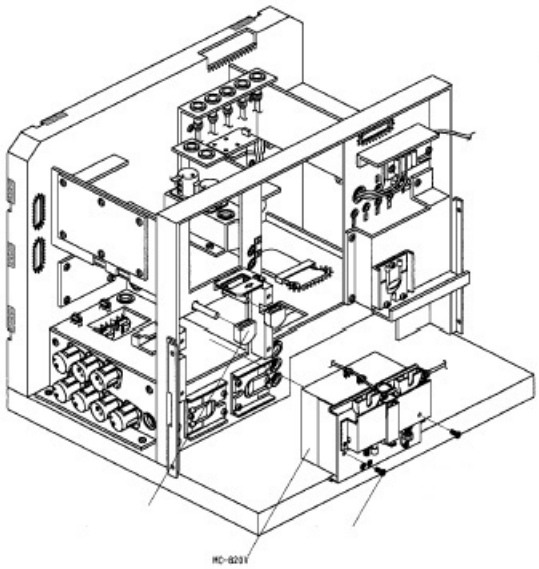
1. Remove the 7 tube joints (Index No. 15, 16, 17, 18, 20, 21, 22) from the CBC measuring unit.



2. Remove the sample cup from the CBC measuring unit by pressing the hook of the sample cup and turning the sample cup down.

3. Remove the 2 black screws which secure the CBC measuring unit to the chassis as shown below.

4. Slowly remove the CBC measuring unit from the instrument while removing the 2 sub baths from the shafts.



Front view

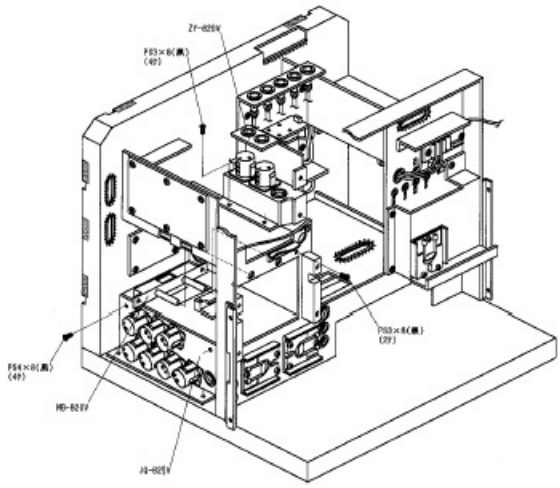
5. Disconnect the 2 cables connected to the SLAVE CBC board at the CBC measuring unit.

6. Disconnect the 2 cables connected to the DRIVER2 board at this board.

7. Completely remove the CBC measuring unit from the instrument.

Removing the MB-820V Sub Bath Unit

1. Remove the 2 black screws which secure the sub bath unit to the chassis.
2. Disconnect the 2 cables connected to the DRIVER4 board at this board.
3. Remove the sub bath unit from the instrument.



Front view

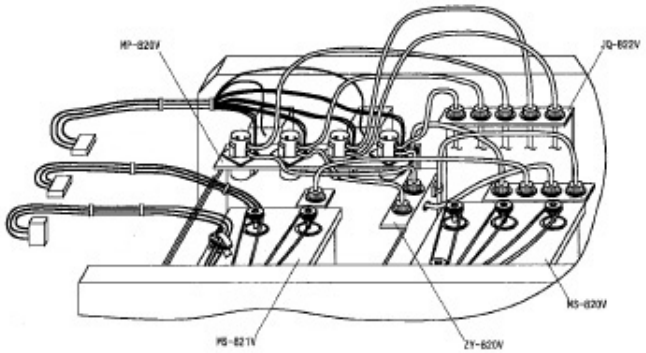
Removing the MP-820V Complex Pump Unit

The complex pump unit consists of the following.

- Cylinder and piston
- 3-way valves (XP-513V and XP-503V)
- MP CONNECTION board
- MD CONNECTION board
- Stepping motors and ball screws

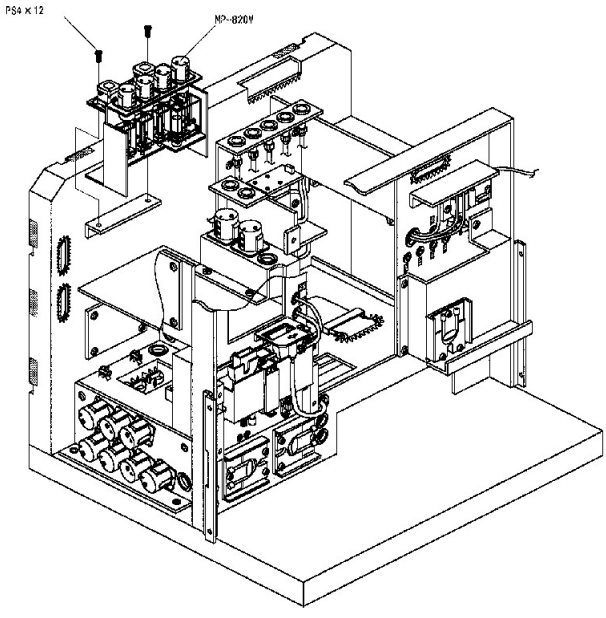
1. Disconnect the 2 cables connected to the DRIVER4 board at this board.

2. Remove the 8 tube joints from the JQ-822V center piping unit, ZY-820V warmer unit and MS-820V closed sampler unit.



3. Remove the 2 black screws which secure the complex pump unit to the chassis.

4. Remove the complex pump unit from the instrument.



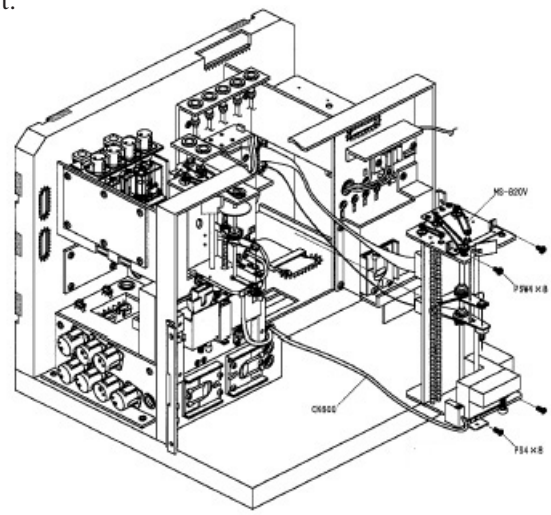
Front view

Removing the MS-820V Closed Sampler Unit

The closed sampler unit consists of the following.

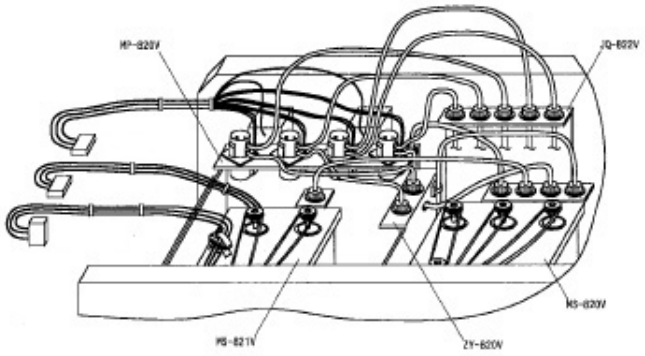
- Photo sensors
- Stepping motors and ball screws
- 3POS SENSOR board
- Rinse unit
- Mixing unit

1. Disconnect the 2 cables connected to the SLAVE MS board at the closed sampler unit.



Front view

2. Remove the 5 tube joints from the closed sampler unit.



3. Remove the 4 black screws which secure the closed sampler unit to the chassis.
4. Remove the closed sampler unit from the instrument.

CAUTION in Assembling the Instrument

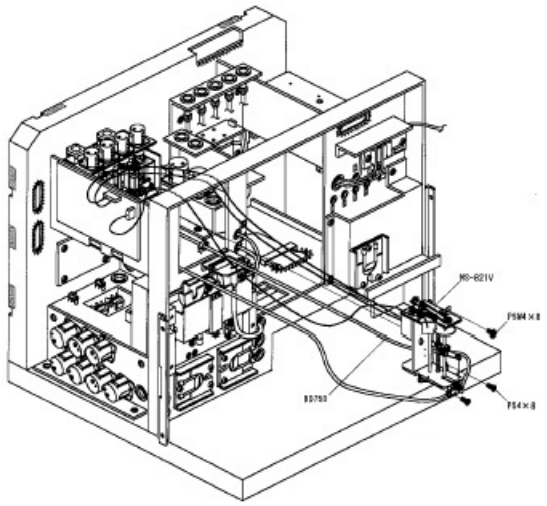
Put the closed sampler unit back to the original position and move the unit to the left as much as possible. Fasten the unit to the chassis with the black screws.

Removing the MS-821V Open Sampler Unit

The open sampler unit consists of the following.

- Photo sensors
- Stepping motor and lead screw
- SENSOR board
- Rinse unit

1. Disconnect the 2 cables connected to the DRIVER4 board at this board.



Front view

2. Remove the black tube joint (No. 9) from the closed sampler unit.

3. Remove the 3 black screws which secure the open sampler unit to the chassis.

4. Remove the open sampler unit from the instrument.

CAUTION in Assembling the Instrument

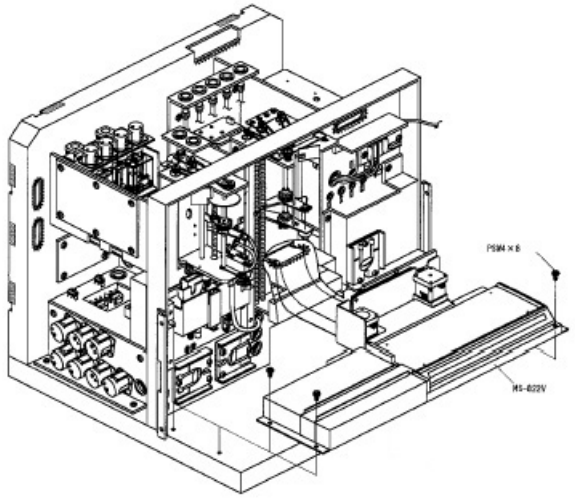
Put the open sampler unit back to the original position and move the unit to the left as much as possible. Fasten the unit to the chassis with the black screws.

Removing the MS-822V Table Unit

The table unit consists of the following.

- SENSOR3 board
- TABLE SENSOR board
- DRIVER5 board
- Stepping motors
- Linear slide

1. Remove the 3 screws which secure the table unit to the chassis as shown below.



Front view

2. Slowly remove the table unit from the instrument until you can disconnect the 2 cables connected to the SLAVE MS board at the table unit.

3. Disconnect the 2 cables from the table unit and remove the table unit from the instrument.

CAUTION in Assembling the Instrument

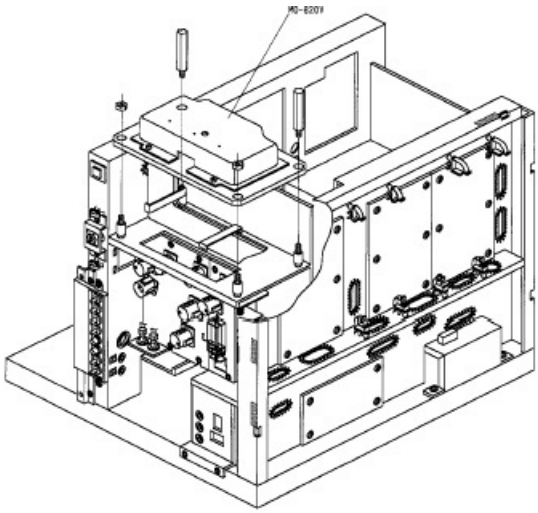
Put the table unit back to the original position and move the unit to the left as much as possible. Fasten the unit to the chassis with the black screws.

Removing the MO-820V Laser Optical Unit

The laser optical unit consists of the following.

- MO LD DRIVER board
- MO preamp boards
- Flow cell unit
- Laser diode

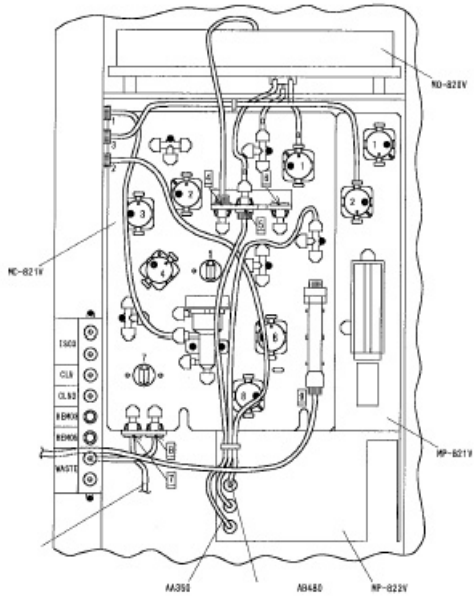
1. Remove the 2 nuts and 2 spacers from the laser optical unit as shown below.



Rear view

2. Disconnect the cable connected to the MASTER board at this board.

3. Disconnect the 3 tubes from the flow cell unit. Remove the tube joint (No.4) from the MC-821V flow cytometry piping unit as shown below.



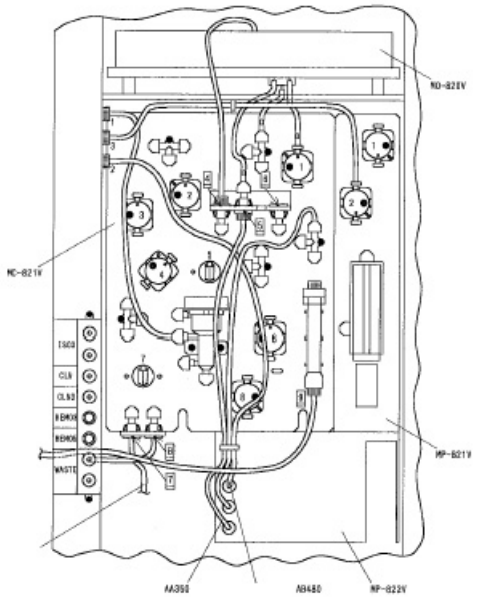
4. Remove the laser optical unit from the instrument.

Removing the MP-821V Sample Pump Unit

The sample pump unit consists of the following.

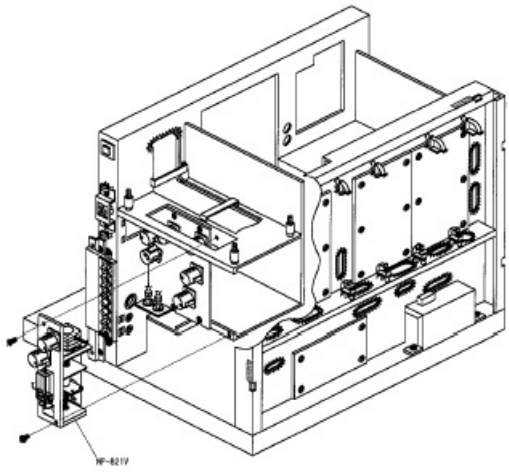
- Cylinder and piston
- 2-way valve XP-512V
- Stepping motor and lead screw
- Photo sensors

1. Remove the tube joint (No. 6) from the MC-821V flow cytometry piping unit.



2. Remove the tube joint (No. 3) from the JQ-820V inlet/outlet unit

3. Remove the 2 black screws which secure the sample pump unit to the chassis. Slowly pull down the top of this unit and pull it upward until you can disconnect the 2 cables connected to the DRIVER1 board at this board.



Rear view

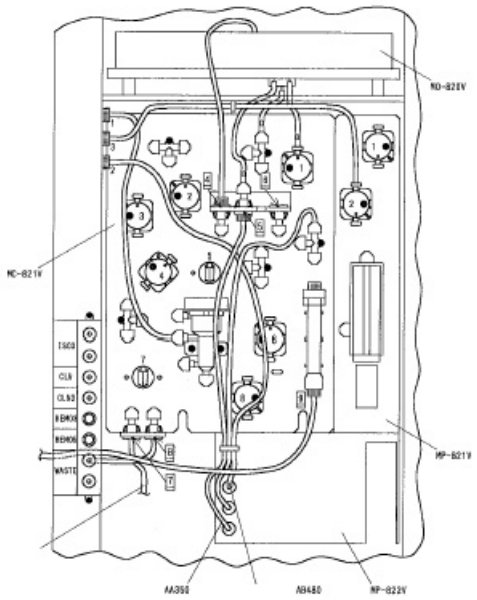
4. Disconnect the 2 cables from the sample pump unit and completely remove it from the instrument.

Removing the MP-822V Sheath Pump Unit

The sheath pump unit consists of the following.

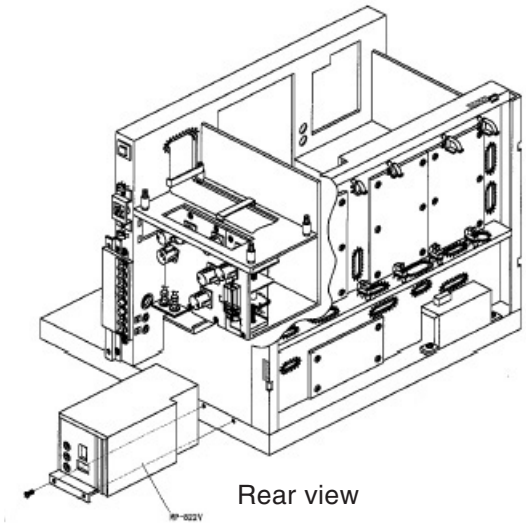
- Diaphragm pump
- 2-way valve XP-512V
- Air tank
- Regulator
- Pressure sensor and SHEATH CONTROL board
- Sheath tank and LIQUID LEVEL SENSOR board

1. Remove the 3 tube joints from the sheath pump unit.



2. Disconnect the cable connected to the MASTER board at the sheath pump unit.

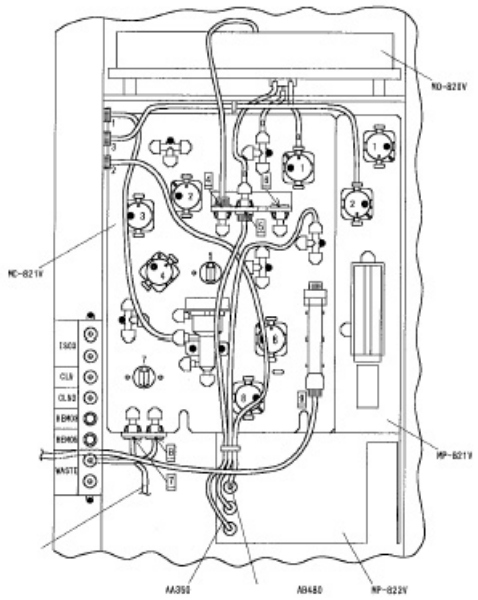
3. Remove the 2 black screws which secure the sheath pump unit to the chassis. Remove the unit from the instrument.



Rear view

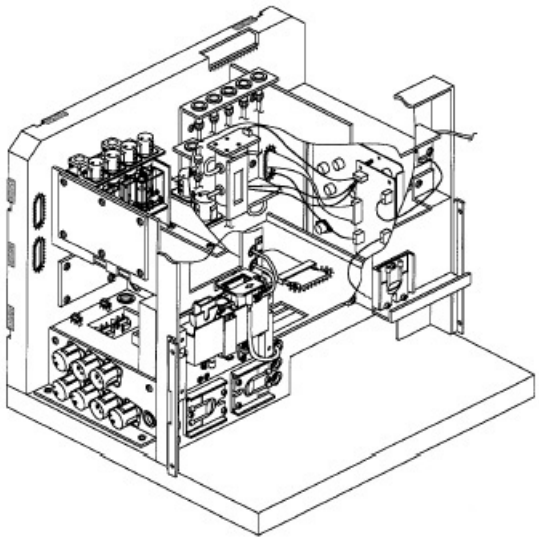
Removing the MC-821V Flow Cytometry Piping Unit

1. Remove the 6 tube joints (No. 4 to No. 9) from the flow cytometry piping unit as shown below. Disconnect the 3 tubes from the laser optical unit if connected.



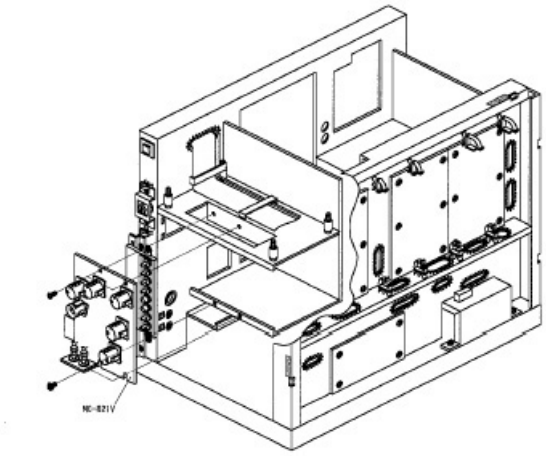
2. Remove the tube joint (No. 1) from the JQ-820V inlet/outlet unit.

3. Disconnect the following cable from the DRIVER1 board.
   - Cable connected to the pump unit
   - Cable connected to the 4WAY LIQUID SENSOR board
   - Cable connected to the JQ-822V center piping unit
   - 2 Cables connected to the MP-821V sample pump unit
   - 2 Cables connected to the MASTER board



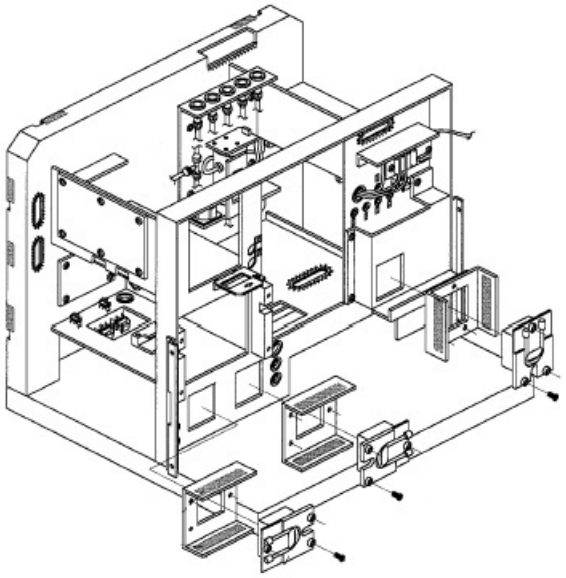
Front view

4. Remove the 2 black screws which secure the flow cytometry piping unit to the chassis. Remove the unit from the instrument.



Rear view

Removing the MP-520V Pump Unit



Front view

RBC pump unit

1. Remove the 2 tube joints from the pump unit.
2. Disconnect the cable connected to the DRIVER2 board at this board.
3. Remove the 3 black screws which secure the pump unit to the chassis through the shield cover.
4. Remove the pump unit from the instrument.

WBC pump unit

1. Remove the 2 tube joints from the pump unit.
2. Disconnect the cable connected to the DRIVER2 board at this board.
3. Remove the 3 black screws which secure the pump unit to the chassis through the shield cover.
4. Remove the pump unit from the instrument.

5-part WBC pump unit

1. Remove the 2 tube joints from the pump unit.
2. Disconnect the cable connected to the DRIVER1 board at this board.
3. Remove the 3 black screws which secure the pump unit to the chassis through the shield cover.
4. Remove the pump unit from the instrument.

Section 5 Socket Pin Assignment

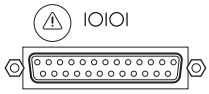
Socket Pin Assignment 5.1
RS-232C Socket 5.1
ZK-820V Socket 5.1
USB Socket 5.1

Socket Pin Assignment

CAUTION

Connect only the specified instruments to the connectors or sockets marked with ⚠ by following the specified procedure. Otherwise electrical leakage current may harm the operator.

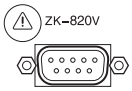
RS-232C Socket



D sub 25 pin (female)
SDBB-25S-SL-LNK (02)

Pin No.	Signal	Pin No.	Signal	Pin No.	Signal
1	NC	10	NC	19	NC
2	TXD1	11	NC	20	(To pin 6)
3	RXD1	12	NC	21	NC
4	RTS1	13	NC	22	NC
5	CTS1	14	NC	23	NC
6	(To pin 20)	15	NC	24	NC
7	SG	16	NC	25	NC
8	NC	17	NC		
9	NC	18	NC		

ZK-820V Socket



Pin No.	Signal	Pin No.	Signal	Pin No.	Signal
1	FG	4	(To pin 6)	7	CTS0
2	TXD0	5	SG	8	RTS0
3	RXD0	6	(To pin 4)	9	VCC

USB Socket

Pin No.	Signal
1	NC
2	USB-D+
3	USB-D–
4	ED

Section 6 Adjustment

Adjusting the Flow Cell Position 6.1
Adjusting the FS/FL/SD Gain and FS Threshold 6.4
Adjusting Sensors 6.7
SENSOR MONITOR screen 6.7
How to call up the SENSOR MONITOR screen 6.7
CBC Manometer 6.8
WBC manometer upper sensor adjustment 6.9
WBC manometer lower sensor adjustment 6.9
RBC manometer upper sensor adjustment 6.9
RBC manometer lower sensor adjustment 6.9
CBC Electrode 6.10
HGB Sensor 6.11
HGB sensor adjustment 6.11
Calibration Switch 6.12
Liquid Sensor 6.13
4-channel liquid sensor unit adjustment 6.15
Pressure Sensor 6.19
Temperature Sensor 6.20
Setting on the UT-7159 WARMER CONTROL board 6.21
Calibrating the Touch Screen 6.22

Adjusting the Flow Cell Position

The following problems require adjustment of the flow cell position.

- When a blood sample collected from a healthy person is counted, the scattergram shows that the 5 parts of WBC are not clearly separated.
- When the 7 µm polymer microsphere suspensions are counted in the Particle Measurement mode, one of the CV values of FS and FL stays in the following percentage.

  CV of FS: Higher than 7%

  CV of FL: Higher than 7%

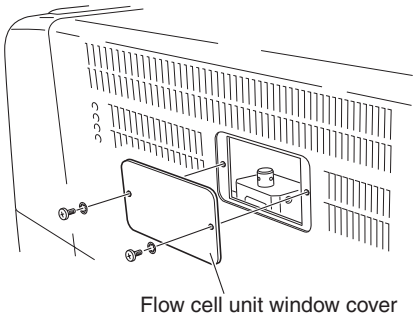
Adjust the flow cell position (rough adjustment of the gain for WBC 5 part differential measurement) by measuring 7 µm polymer microsphere suspensions. The DIFF GAIN screen can only be entered when the type of operator is lab technician or manufacturer.

Observe the instructions on the 7 µm polymer microsphere suspensions manual to achieve optimum performance and safety.

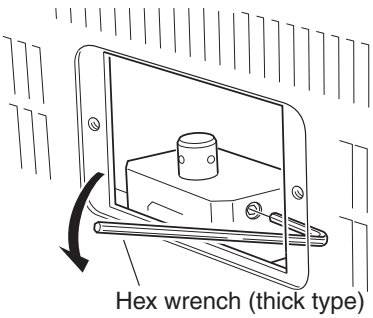
CAUTION

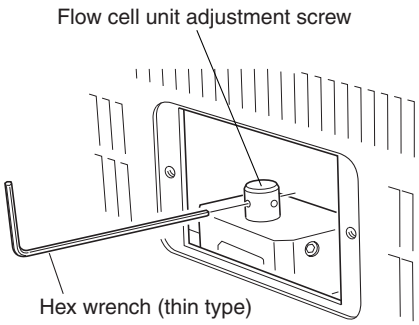
- **Do not swallow the polymer microsphere suspensions. If swallowed, contact your physician immediately.**
- **Avoid contact with the mouth and eyes. If the polymer microsphere suspensions contacts the mouth or eyes, wash thoroughly and immediately with water, and contact your physician immediately.**

1. Remove the flow cell unit window cover on the right side panel by removing two screws.



2. Loosen the screw fastening the flow cell unit adjustment screw with the thick hex wrench. Turn the screw counterclockwise.



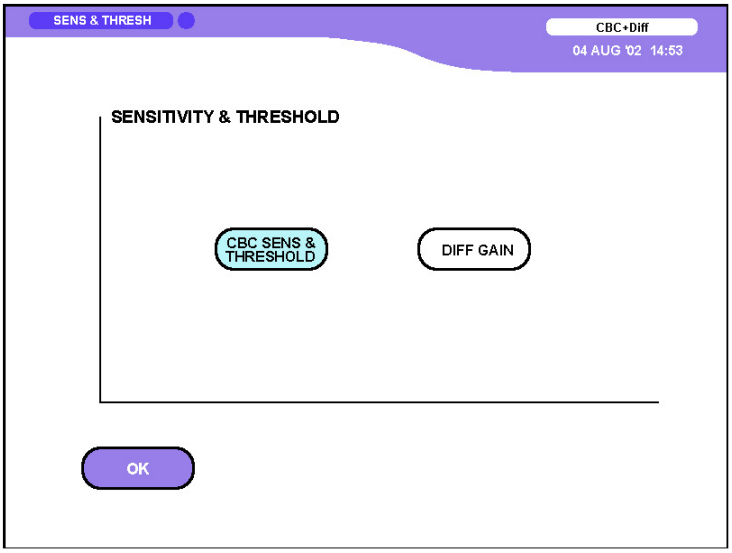


3. Insert the thin hex wrench into the flow cell adjustment screw.

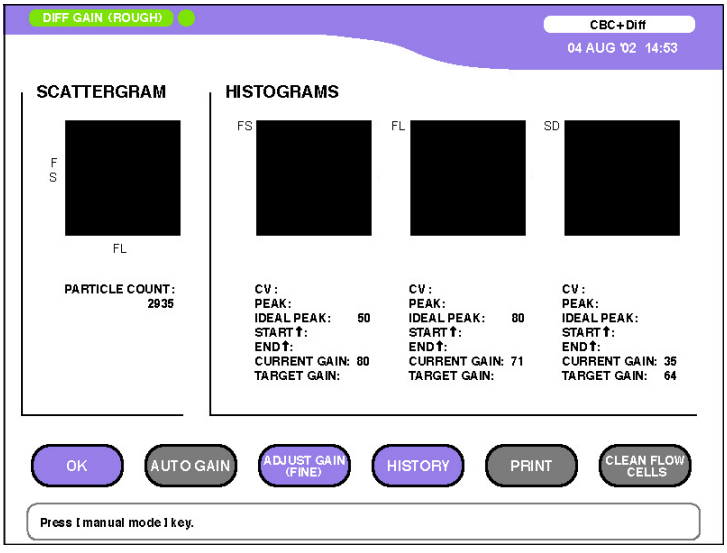
4. Prepare the polymer microsphere suspensions in a sample tube and 10 blood samples of different healthy people within 12 hours after collection.

5. Press the SETTINGS key on the MENU screen to display the SETTINGS screen.

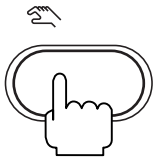
6. Press the SENSITIVITY THRESHOLD key on the SETTINGS screen to display the SENS & THRESH screen.



7. Press the DIFF GAIN key to display the DIFF GAIN (ROUGH) screen.

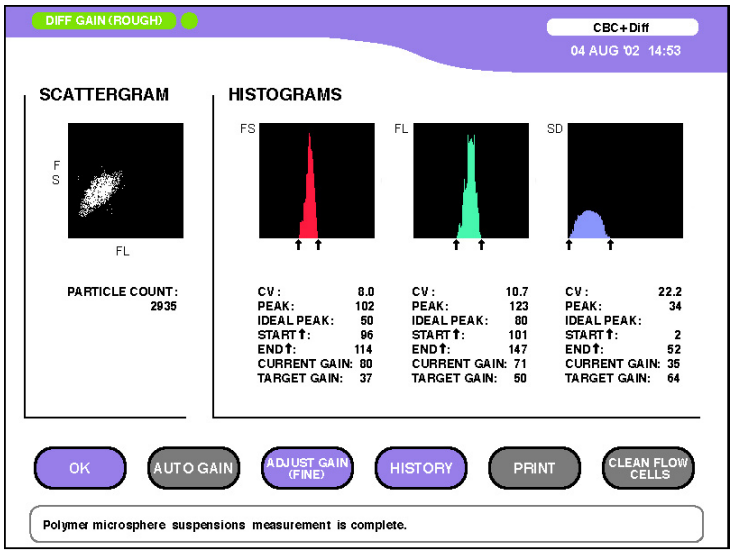


The ideal peak and current gain values are displayed on the screen.



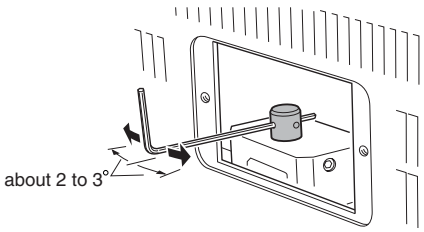
8. Press the Manual mode key on the front panel to enter manual mode, put the sampling nozzle into the bottom of the sample tube containing the polymer microsphere suspensions so that the tip of the sampling nozzle touches the bottom of the sample tube, and press the Manual count switch. The polymer microsphere suspensions is aspirated and measurement starts.

   The result appears on the screen. When the CV of FS and FL are below 7%, go to step 10.



   When the result is not optimum, press the CLEAN FLOW CELLS key to clean the flow cell unit. After cleaning, measure the polymer microsphere suspensions again.

   When the result is still not optimum, do the next step.



9. Turn the flow cell adjustment screw about 2 or 3° and press the CLEAR key to redraw the histograms.

   The polymer microsphere suspensions measurement lasts for about 25 seconds. If adjusting the flow cell unit is not complete within this period, measure polymer microsphere suspensions again.

   If the histograms are narrower than before, turn the flow cell adjustment screw in the same direction.

   If the histograms are wider than before, turn the flow cell adjustment screw in the opposite direction.

   Repeat drawing histograms, adjusting flow cell unit and redrawing histograms until you obtain the optimum result.

10. Fasten the flow cell unit adjustment screw.

11. Press the AUTO GAIN key to change the current gain to the target gain.

Adjusting the FS/FL/SD Gain and FS Threshold

Before performing this adjustment, check that the CV values of FS and FL meet the following conditions by measuring the 7 µm polymer microsphere suspensions.

FS ≤ 7%

FL ≤ 7%

Refer to “Adjusting the Flow Cell Position”.

1. Press the ADJUST GAIN (FINE) key to display the DIFF GAIN (FINE) screen.

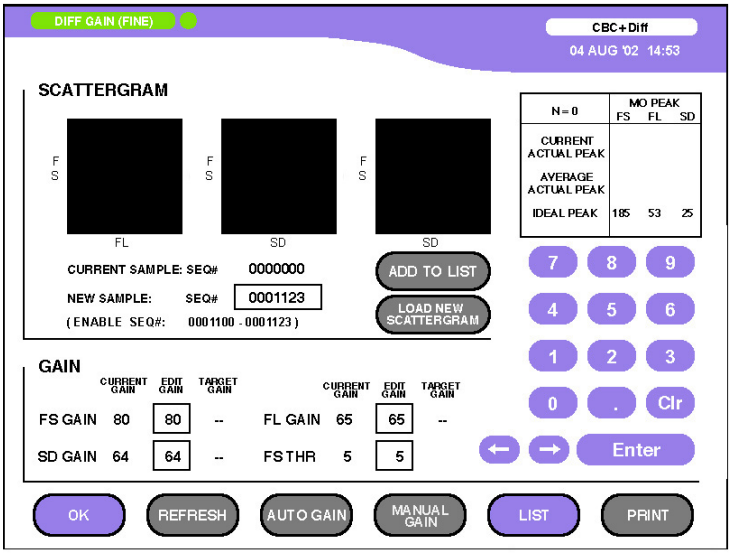
   The “For fine adjustment, human blood must be measured. Go to READY screen, measure blood and return to this screen. Go to READY screen?” message is displayed.

2. Press the YES key and go to the READY screen.

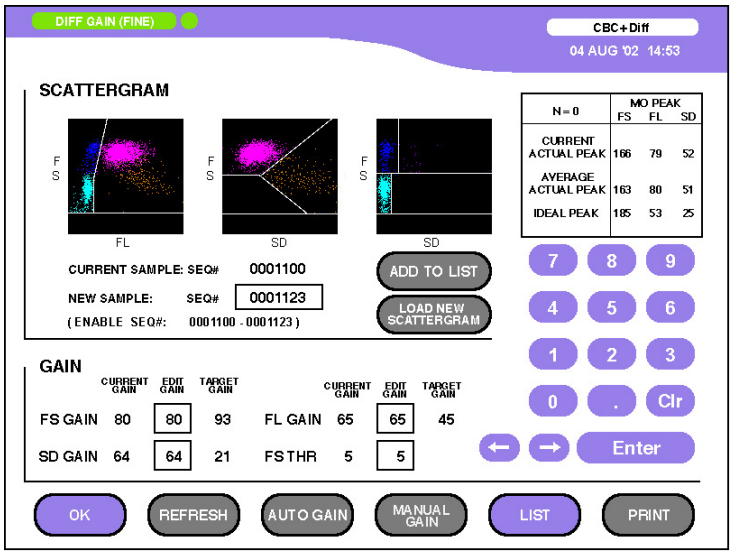
3. Set the 10 human blood samples which were prepared in step 4 in the rack and measure them. Make sure that “CBC + Diff” is selected in the “PARAMETERS” box on the READY screen.

   The samples can also be measured manually.

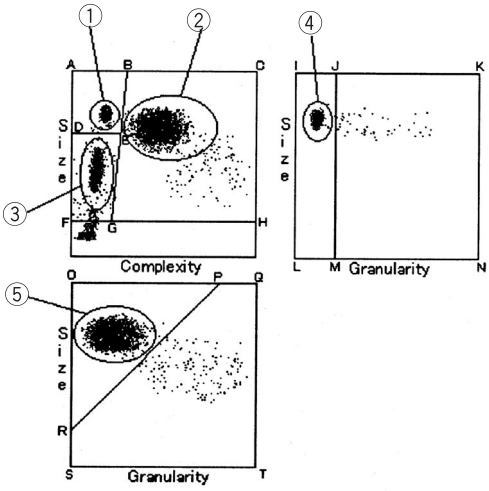
4. Display the DIFF GAIN (FINE) screen.



5. Press the LOAD NEW SCATTERGRAM key to draw scattergrams of the sequence number displayed for “NEW SAMPLE”.



6. When the scattergrams are oval in shape and are not touching the division line, press the ADD TO LIST key to register the data in the ACTUAL PEAK LIST. It does not matter if the scattergrams are not within their allotted area.



Check Points

- Check that the WBC distribution ① is in the square ABED and does not cover the lines AB, BE, ED and DA.
- Check that the WBC distribution ② is in the square BCHG and does not cover the lines BC, CH, HG and GB.
- Check that the WBC distribution ③ is in the square DEGF and does not cover the lines DE, EG, GF and FD.
- Check that the WBC distribution ④ is in the square IJML and does not cover the lines IJ, JM, ML and LI.
- Check that the WBC distribution ⑤ is in the triangle OPR and does not cover the lines OP, PR and RO.

When the scattergrams are not optimum, do not register the data in the gain list.

Draw scattergrams of all samples you measured in step 14. You must have at least one data which has been added to the ACTUAL PEAK LIST.

7. Auto gain adjustment

Press the AUTO GAIN key to change the current gain to the target gain.

Manual gain adjustment

You can also change the gain by using the numeric keys on the screen. Press the MANUAL GAIN key, use the arrow keys to move the cursor to the desired item and enter the number in the EDIT GAIN column.

To adjust size (vertical axis of the scattergram), adjust FS GAIN.
To adjust complexity (horizontal axis), adjust FL GAIN.
To adjust granularity (horizontal axis), adjust SD GAIN.

8. Press the REFRESH key to draw scattergrams with the gain entered in the EDIT GAIN boxes.

9. Press the ADD TO LIST key to register the data in the ACTUAL PEAK LIST.

10. When the gain is adjusted, go to the READY screen and measure human blood sample to check that the scattergrams are optimum and no flags are displayed.

Adjusting Sensors

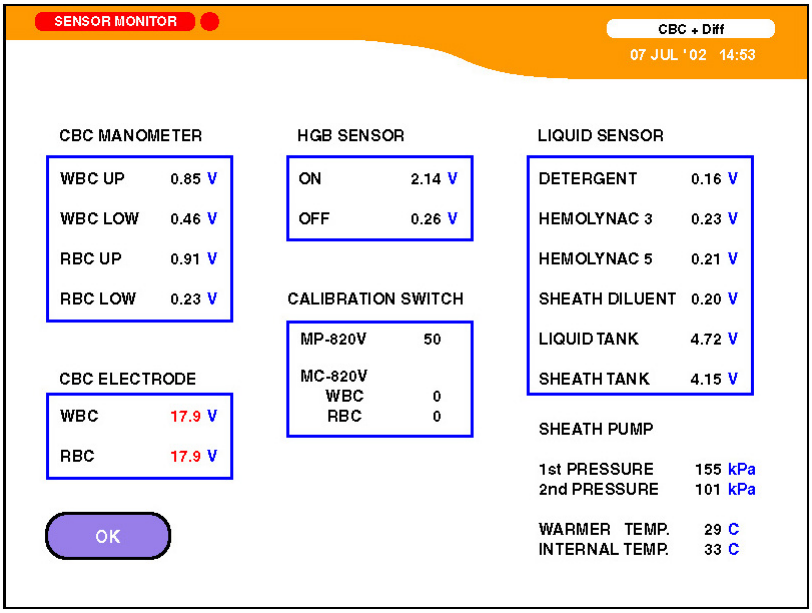
SENSOR MONITOR screen

The SENSOR MONITOR screen displays the real-time outputs of the sensors in the instrument. The displayed output values tell you whether the sensor is functioning correctly, out of adjustment, or faulty.

How to call up the SENSOR MONITOR screen

1. READY screen.
2. Press the MENU touch screen key.
   (MENU screen appears.)
3. Press the OTHER OPERATIONS touch screen key.
   (OTHER OPERATIONS screen appears.)
4. Press the SERVICE MAINTENANCE touch screen key.
   (SERVICE MAINTENANCE screen appears)
5. Press the MONITOR touch screen key.
6. Press the SENSOR MONITOR touch screen key.

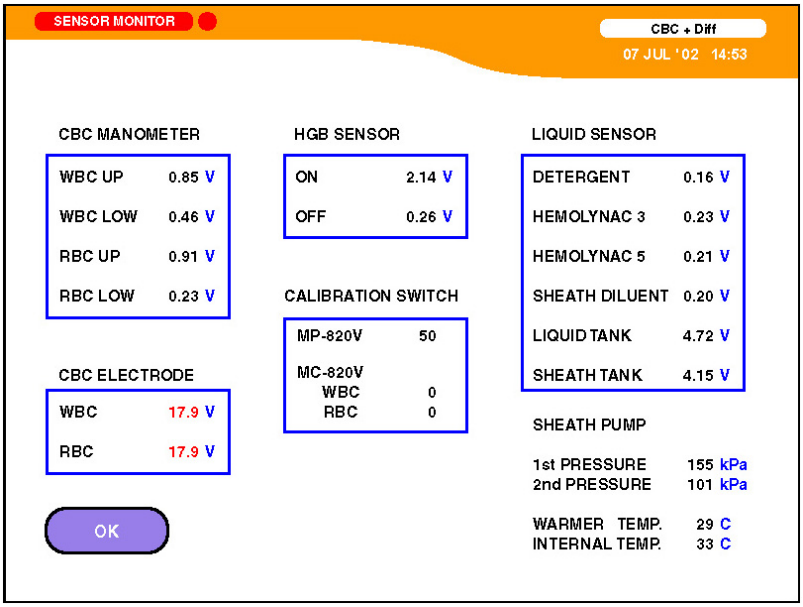
The SENSOR MONITOR screen appears.



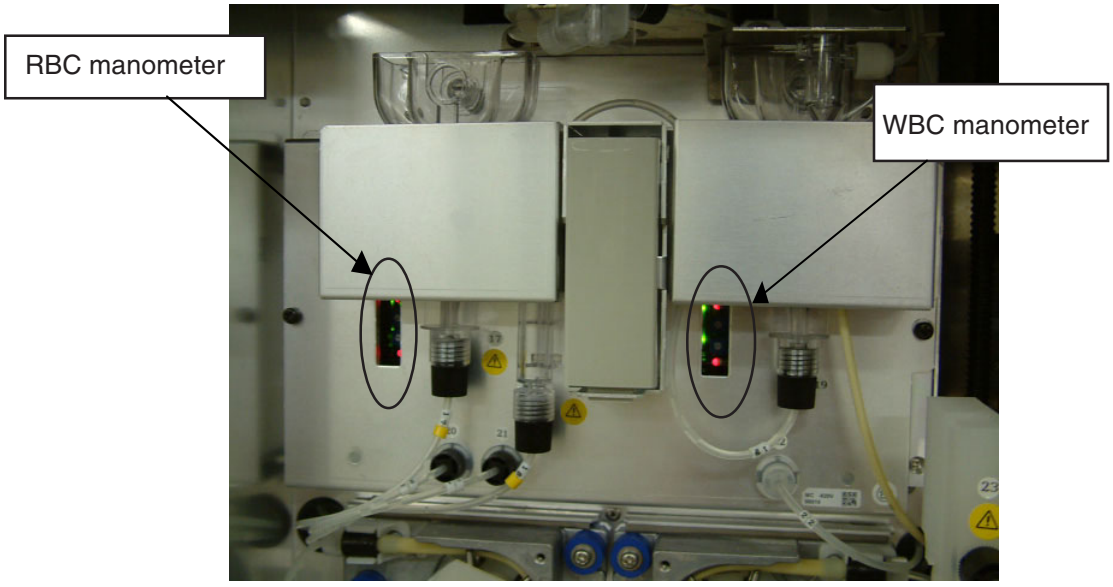
CBC Manometer

The output voltages from the sensors attached to the two manometers in the CBC measuring unit are displayed.

1. WBC UP: Output voltage of the sensor located at the upper position of the WBC manometer
2. WBC LOW: Output voltage of the sensor located at the lower position of the WBC manometer
3. RBC UP: Output voltage of the sensor located at the upper position of the RBC manometer
4. RBC LOW: Output voltage of the sensor located at the lower position of the RBC manometer



Diluent or Sample	Normal Output Voltage
Present	1.5 V or less
Absent	3.5 V or more

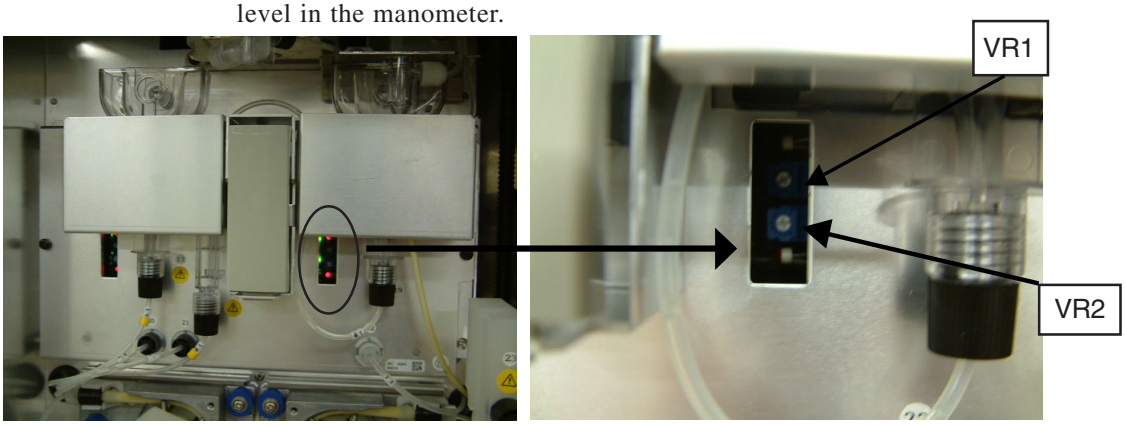


WBC manometer upper sensor adjustment

- Adjust the sensor output control VR1 until the WBC UP value on the screen shows 1.5 V or less when there is liquid at the sensor position level in the manometer.
- Adjust the sensor output control VR1 until the WBC UP value on the screen shows 3.5 V or more when there is no liquid at the sensor position level in the manometer.

WBC manometer lower sensor adjustment

- Adjust the sensor output control VR2 until the WBC LOW value on the screen shows 1.5 V or less when there is liquid at the sensor position level in the manometer.
- Adjust the sensor output control VR2 until the WBC LOW value on the screen shows 3.5 V or more when there is no liquid at the sensor position level in the manometer.

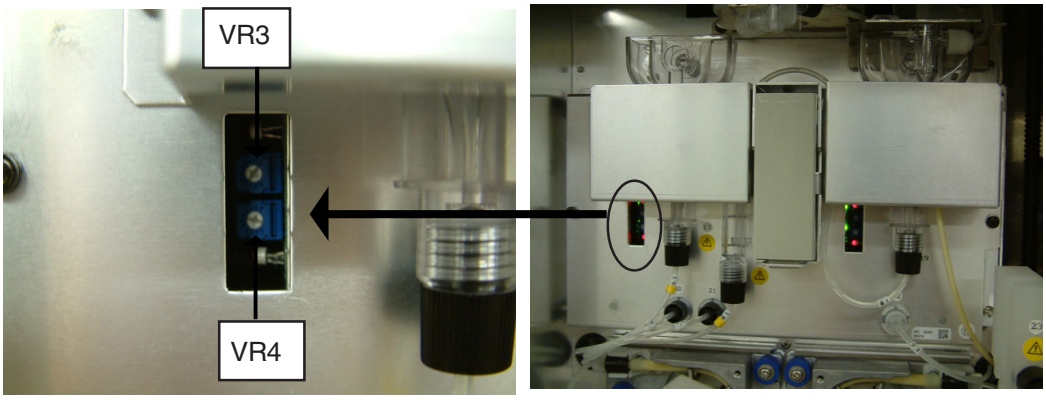


RBC manometer upper sensor adjustment

- Adjust the sensor output control VR3 until the RBC UP value on the screen shows 1.5 V or less when there is liquid at the sensor position level in the manometer.
- Adjust the sensor output control VR3 until the RBC UP value on the screen shows 3.5 V or more when there is no liquid at the sensor position level in the manometer.

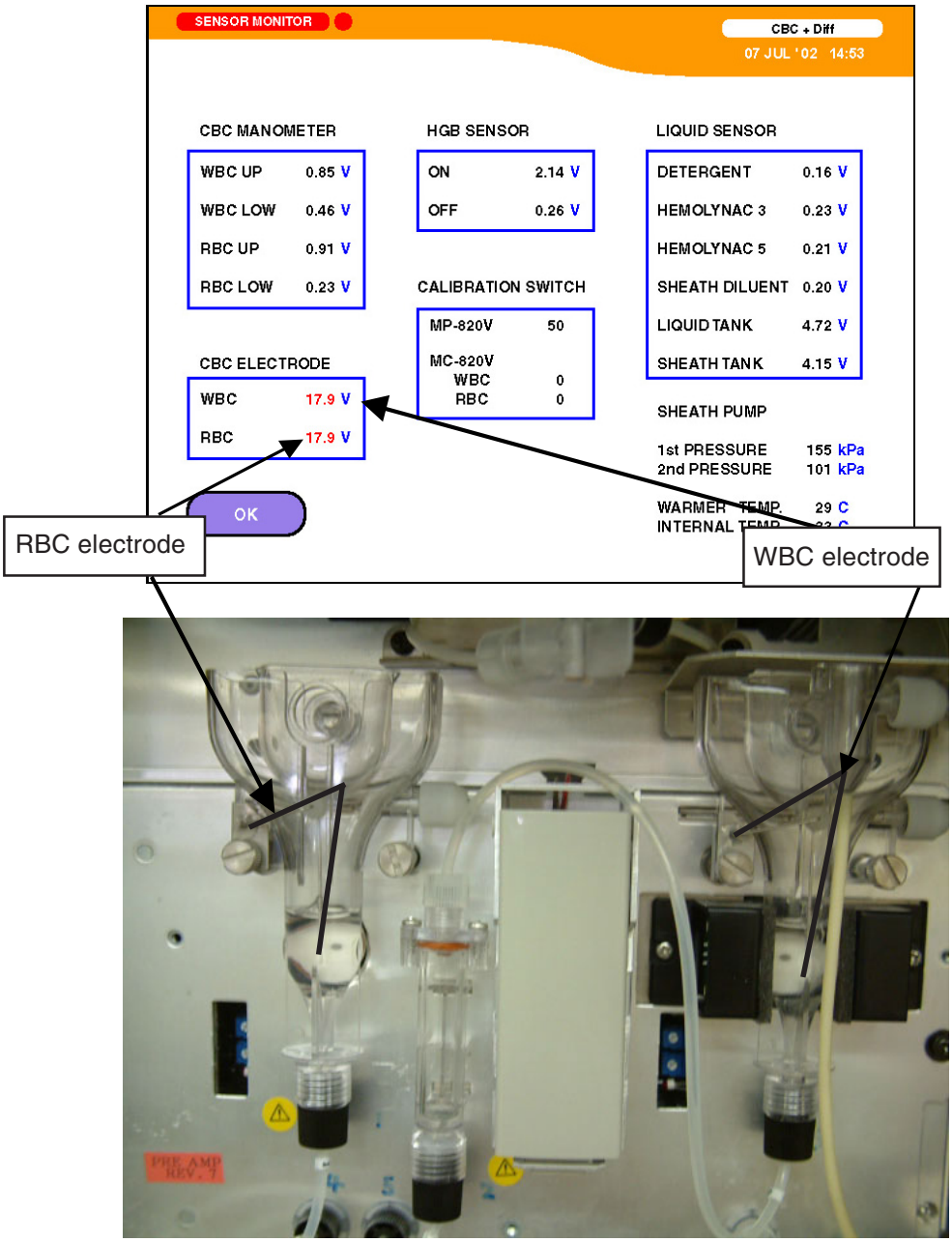
RBC manometer lower sensor adjustment

- Adjust the sensor output control VR4 until the RBC LOW value on the screen shows 1.5 V or less when there is liquid at the sensor position level in the manometer.
- Adjust the sensor output control VR4 until the RBC LOW value on the screen shows 3.5 V or more when there is no liquid at the sensor position level in the manometer.



CBC Electrode

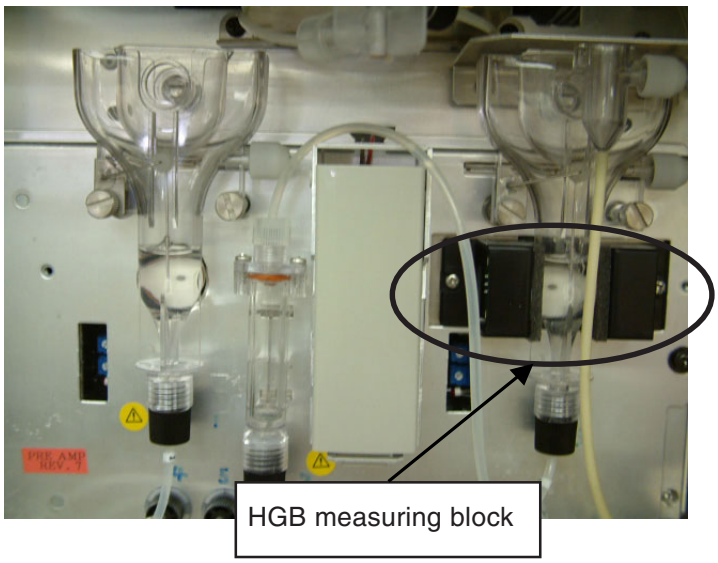
The differential voltages between the two electrodes are displayed.
The normal range of the differential voltage of these electrodes is 18.3 V±0.3 V.



HGB Sensor

HGB sensor output voltage is displayed.

ON: Output voltage from the sensor in the HGB measuring block of the CBC measuring unit when the LED is lit.
The HGB SENSOR ON voltage must be in the range of 3.0 V±0.3 V.
OFF: Output voltage from the sensor in the HGB measuring block of the CBC measuring unit when the LED is not lit.



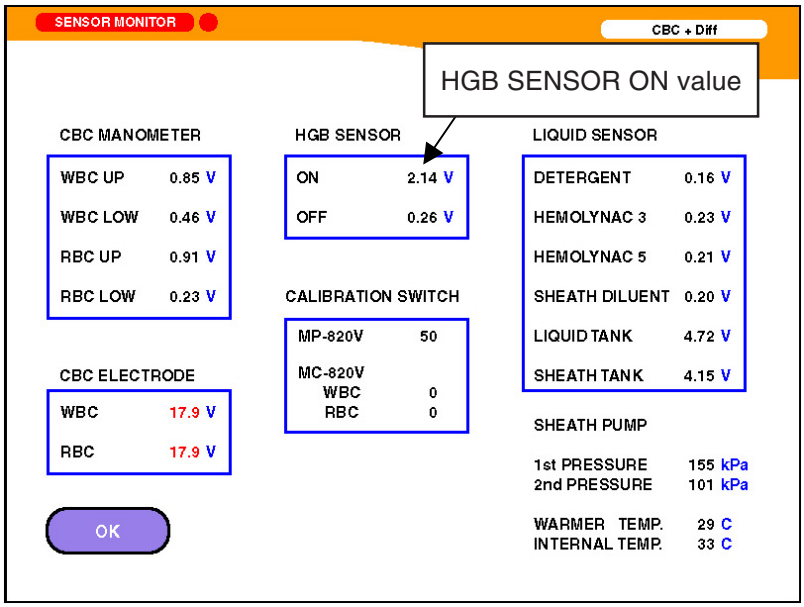
HGB sensor adjustment

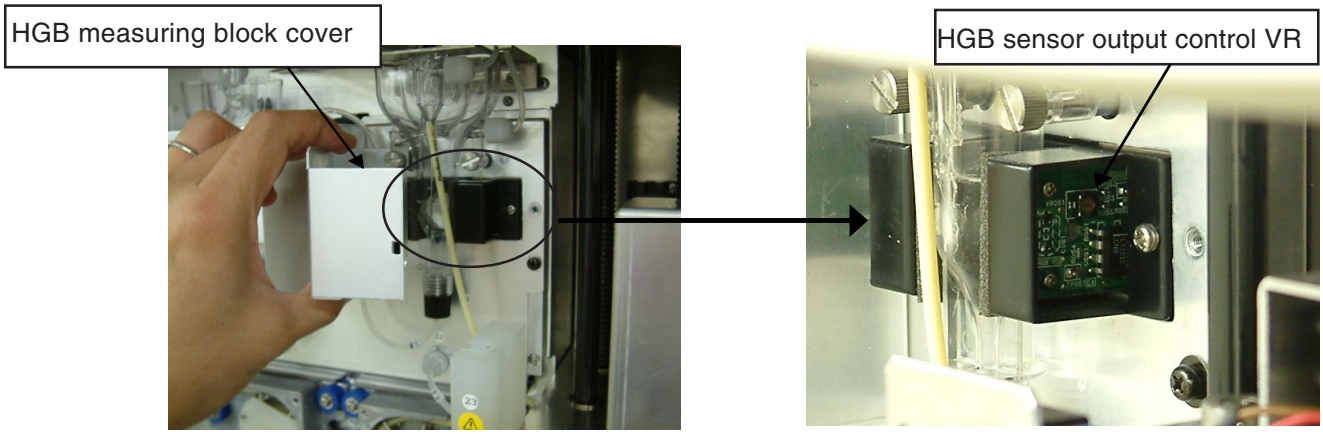
1. Remove the front cover.

2. Remove the HGB measuring block cover.

3. Call up the SENSOR MONITOR screen.

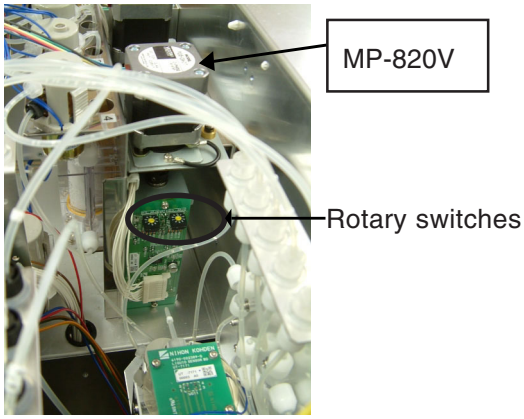
4. Adjust the HGB sensor output control VR until the HGB SENSOR ON value shows 3.0±0.1 V when the WBC measurement bath is filled with diluent.

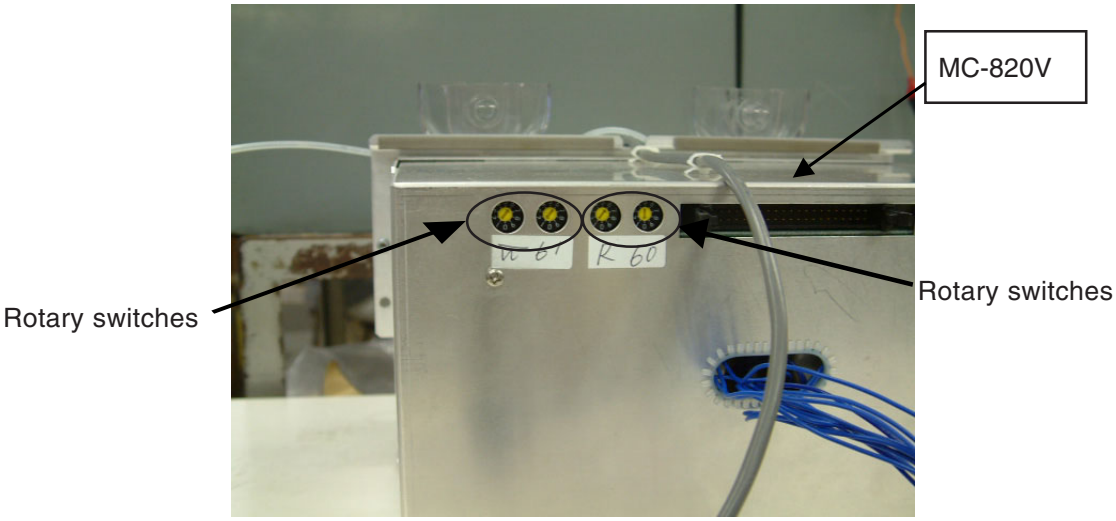




Calibration Switch

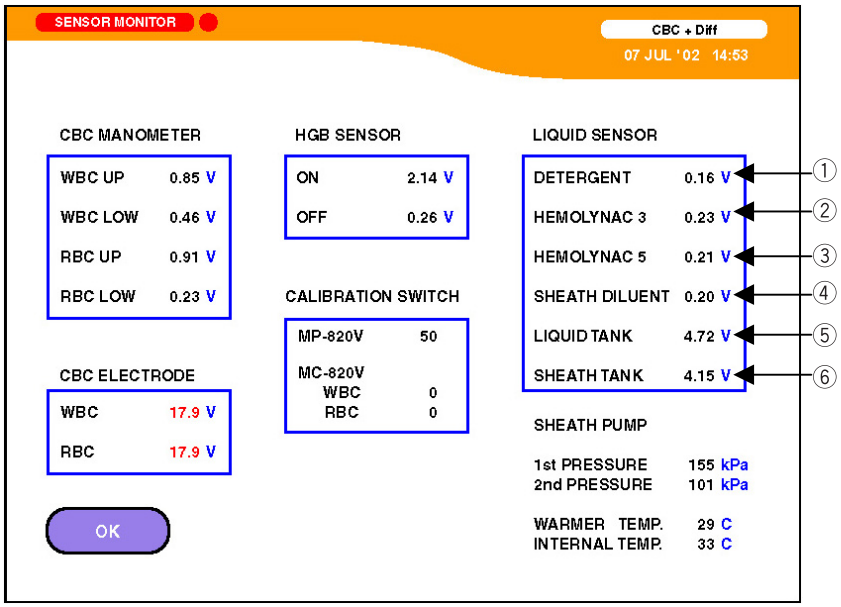
The correction factors of the CBC measuring unit and complex pump unit are displayed.
MP-820V: Correction factor which is set by the rotary switches of the complex pump unit.
MC-820V WBC: Correction factor which is set by the rotary switches of the WBC measuring block of the CBC measuring unit.
MC-820V RBC: Correction factor which is set by the rotary switches of the RBC measuring block of the CBC measuring unit.





Liquid Sensor

The output voltage from each liquid sensor is displayed.

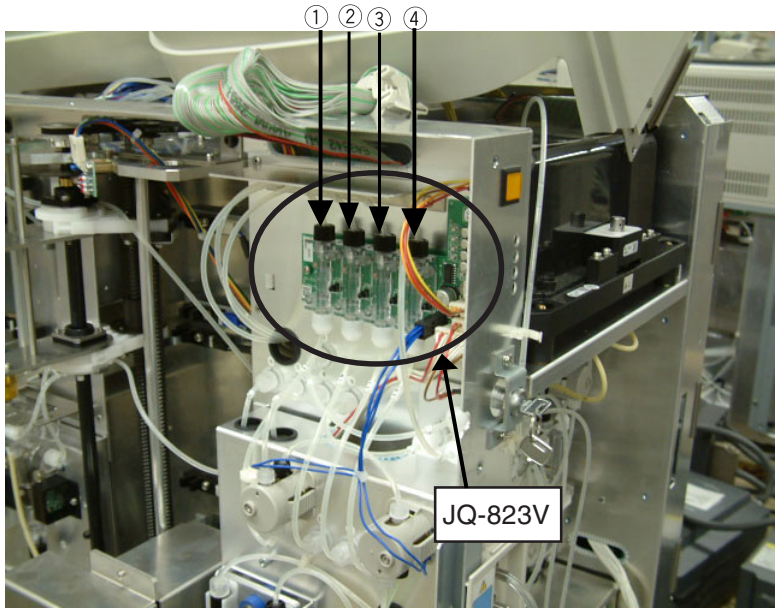


① DETERGENT: Voltage detected by the detergent (CLEANAC and CLEANAC3) detection sensor in the JQ-823V 4-channel liquid sensor unit.

② HEMOLYNAC 3: Voltage detected by the hemolysing reagent (HEMOLYNAC 3) detection sensor in the 4-channel liquid sensor unit.

③ HEMOLYNAC 5: Voltage detected by the hemolysing reagent (HEMOLYNAC 5) detection sensor in the 4-channel liquid sensor unit.

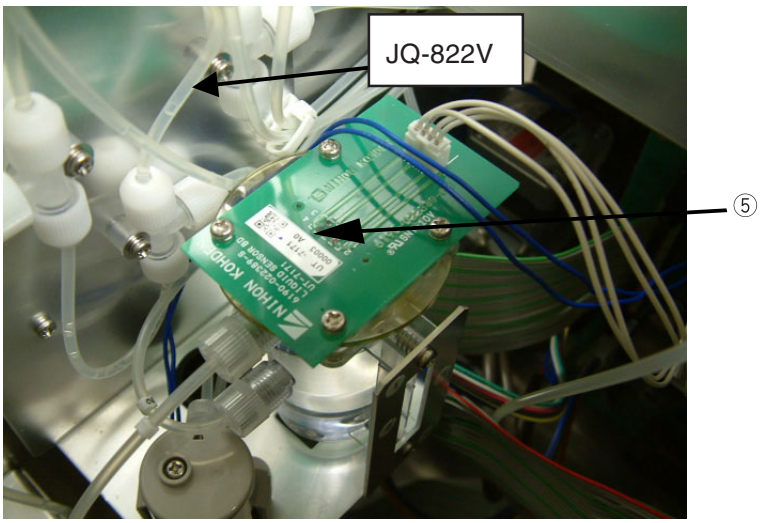
④ SHEATH DILUENT: Voltage detected by the diluent (ISOTONAC 3) detection sensor in the 4-channel liquid sensor unit.

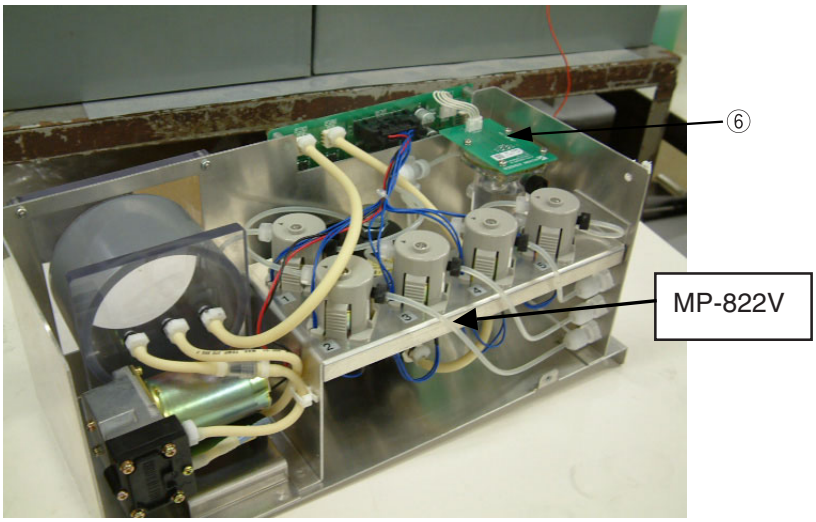


Liquid	Normal Output Voltage
Present	1.5 V or less
Absent	3.5 V or more

⑤ LIQUID TANK: Voltage detected by the diluent (ISOTONAC 3) detection sensor on the UT-7171 LIQUID LEVEL SENSOR board in the JQ-822V center piping unit.

⑥ SHEATH TANK: Voltage detected by the diluent (ISOTONAC 3) detection sensor on the UT-7171 LIQUID LEVEL SENSOR board in the P-822V sheath pump unit.



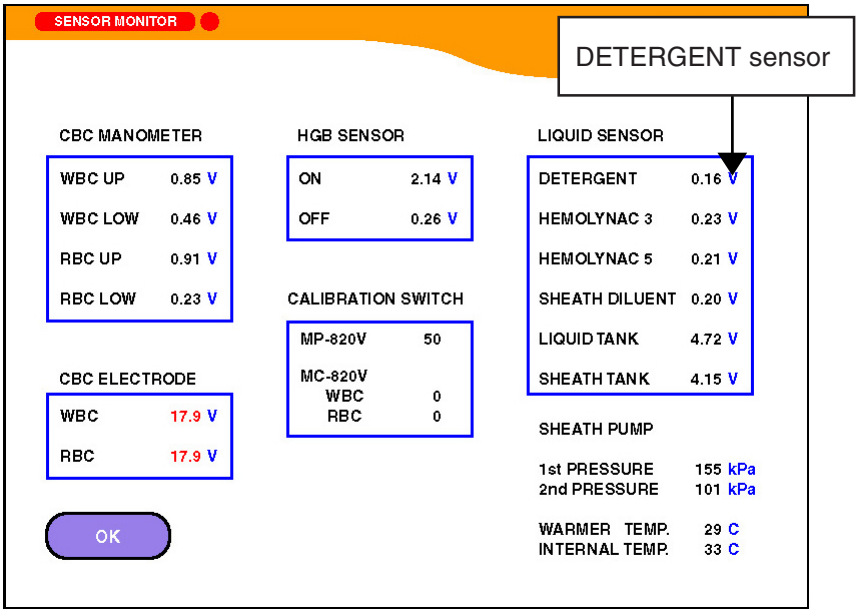


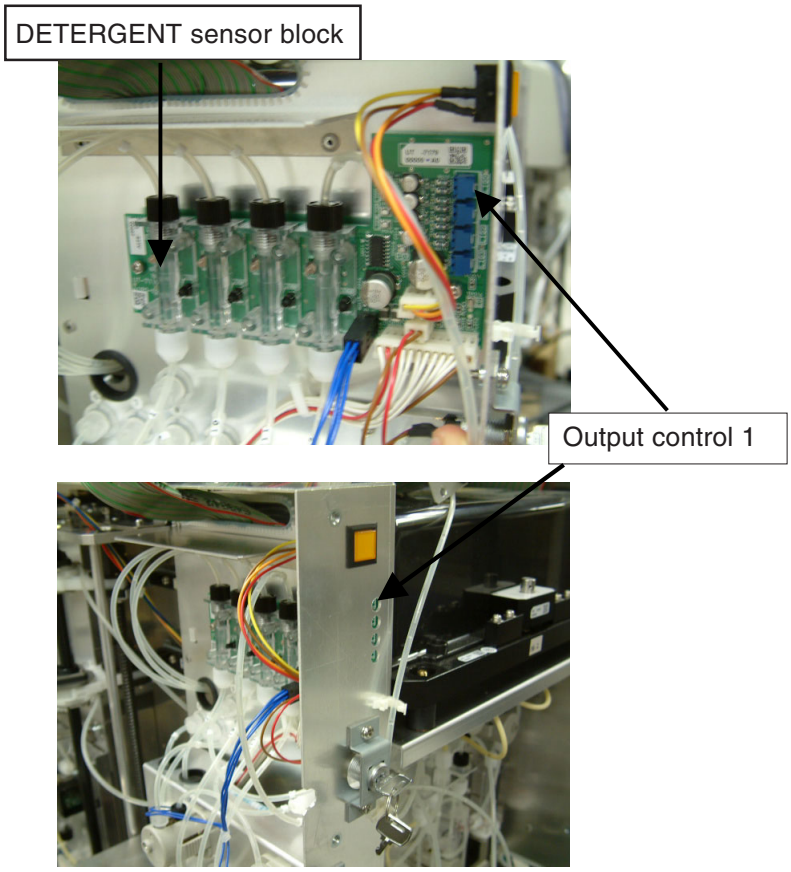
Liquid	Normal Output Voltage
Present	3.5 V or more
Absent	1.5 V or less

4-channel liquid sensor unit adjustment

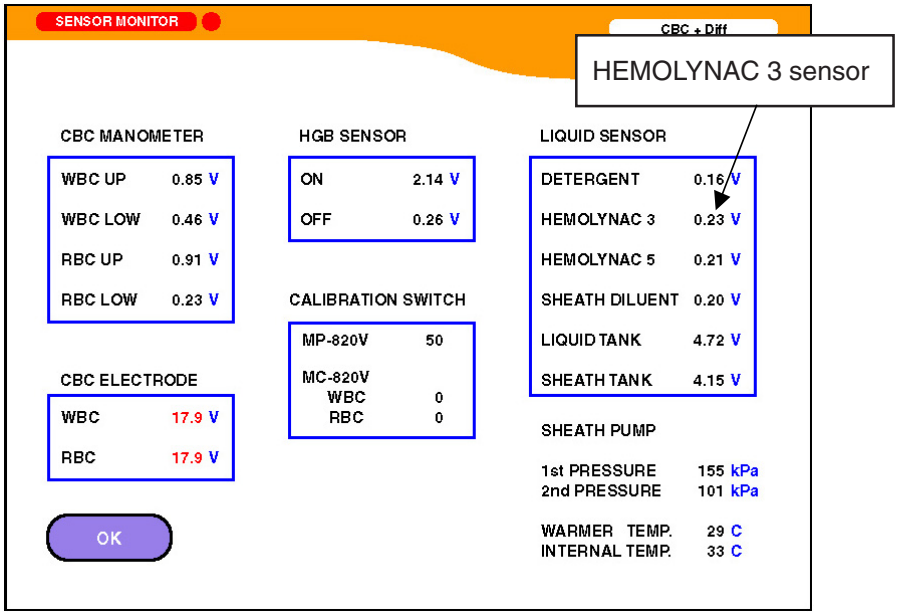
1. Call up the SENSOR MONITOR screen.

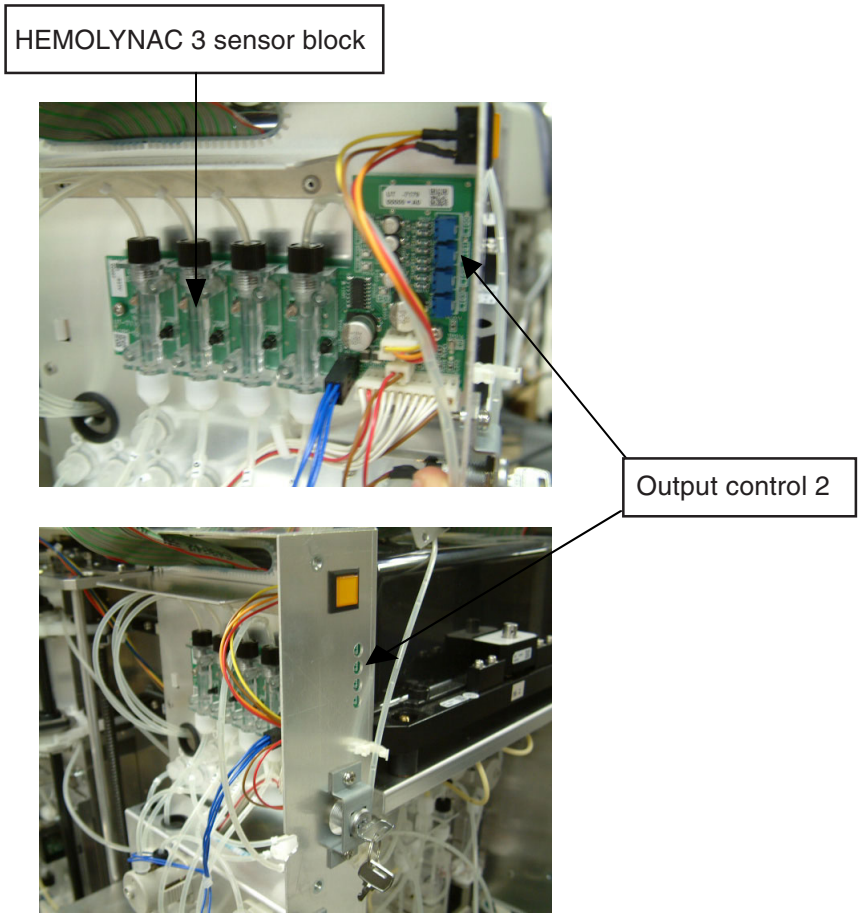
2. Adjust the DETERGENT sensor as follows:
   a. When there is no detergent in the detergent sensor block, adjust the DETERGENT sensor output control 1 until the value indicates 3.5 V or more.
   b. When the detergent sensor block is filled with detergent, adjust the DETERGENT sensor output control 1 until the value indicates 1.5 V or less



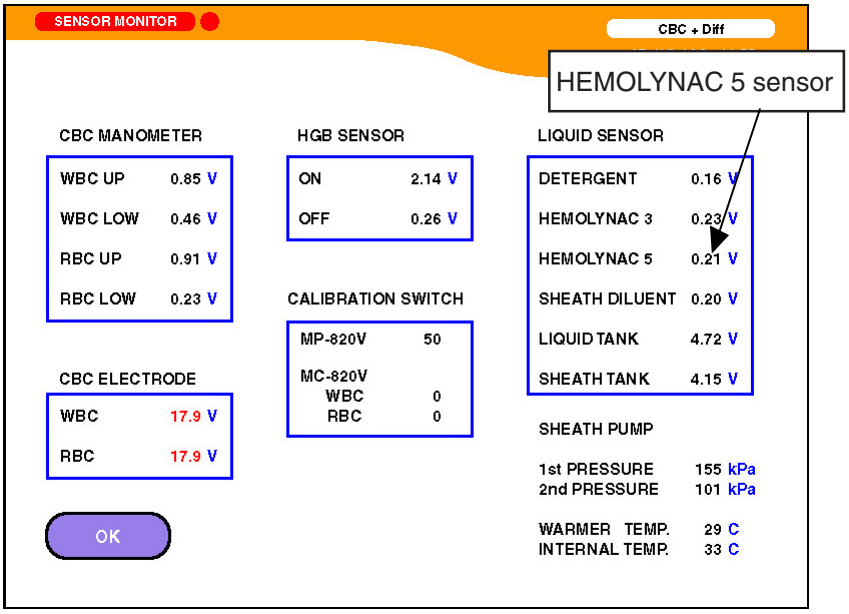


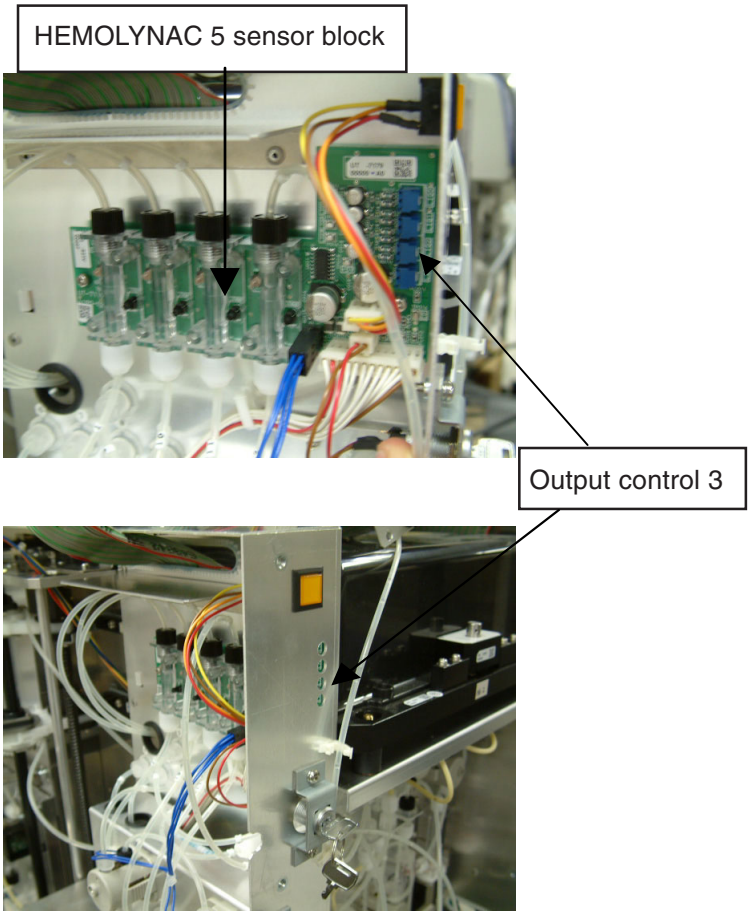
3. Adjust the HEMOLYNAC 3 sensor as follows:
   a. When there is no HEMOLYNAC 3 in the HEMOLYNAC 3 sensor block, adjust the HEMOLYNAC 3 sensor output control 2 until the value indicates 3.5 V or more.
   b. When the detergent sensor block is filled with HEMOLYNAC 3, adjust the HEMOLYNAC 3 sensor output control 2 until the value indicates 1.5 V or less.



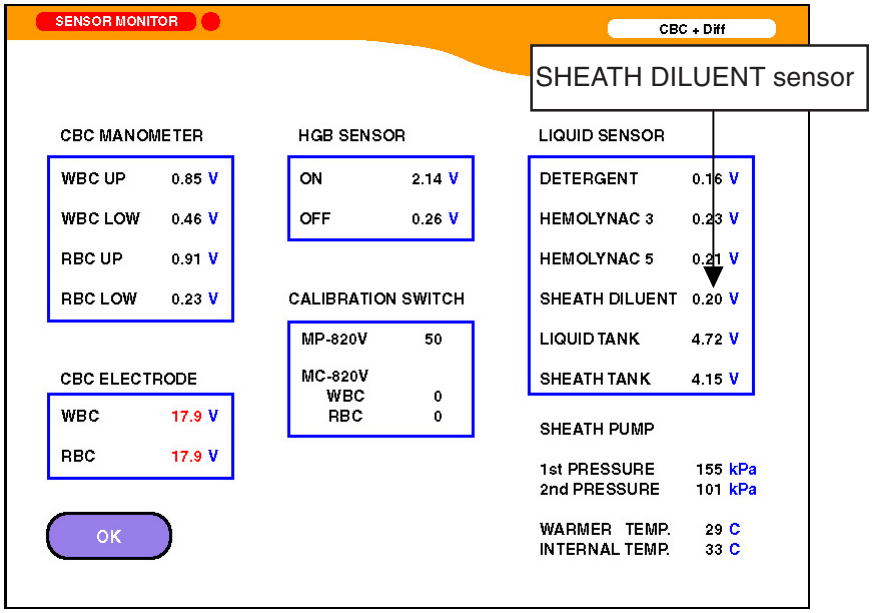


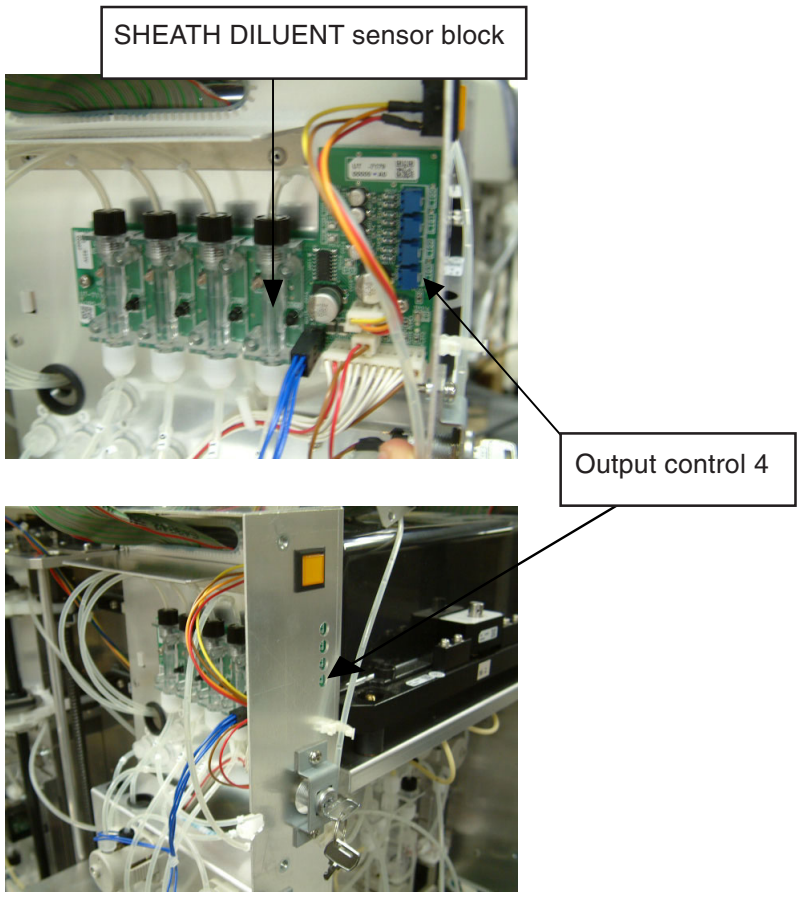
4. Adjust the HEMOLYNAC 5 sensor as follows:
   a. When there is no HEMOLYNAC 5 in the HEMOLYNAC 5 sensor block, adjust the HEMOLYNAC 5 sensor output control 3 until the value indicates 3.5 V or more
   b. When the HEMOLYNAC 5 sensor block is filled with HEMOLYNAC 5, adjust the HEMOLYNAC 5 sensor output control 3 until the value indicates 1.5 V or less





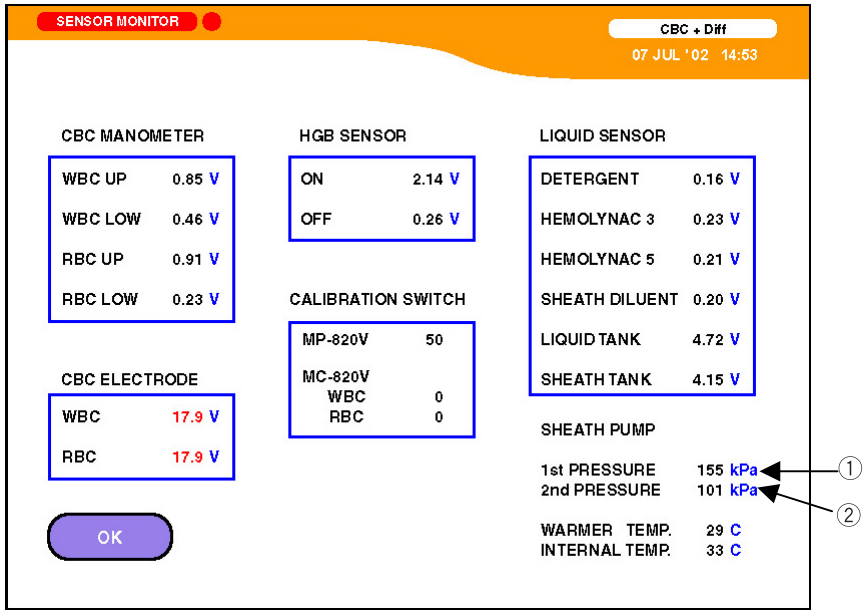
5. Adjust the SHEATH DILUENT sensor as follows:
   a. When there is no diluent in the SHEATH DILUENT sensor block, adjust the SHEATH DILUENT sensor output control 4 until the value indicates 3.5 V or more.
   b. When the SHEATH DILUENT sensor block is filled with diluent, adjust the SHEATH DILUENT sensor output control 4 until the value indicates 1.5 V or less.



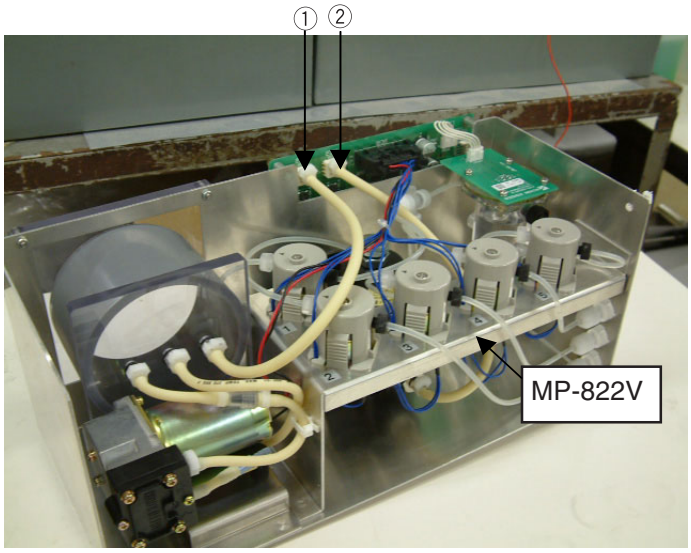


Pressure Sensor

The pressure values detected by the pressure sensors in the sheath pump unit are displayed.



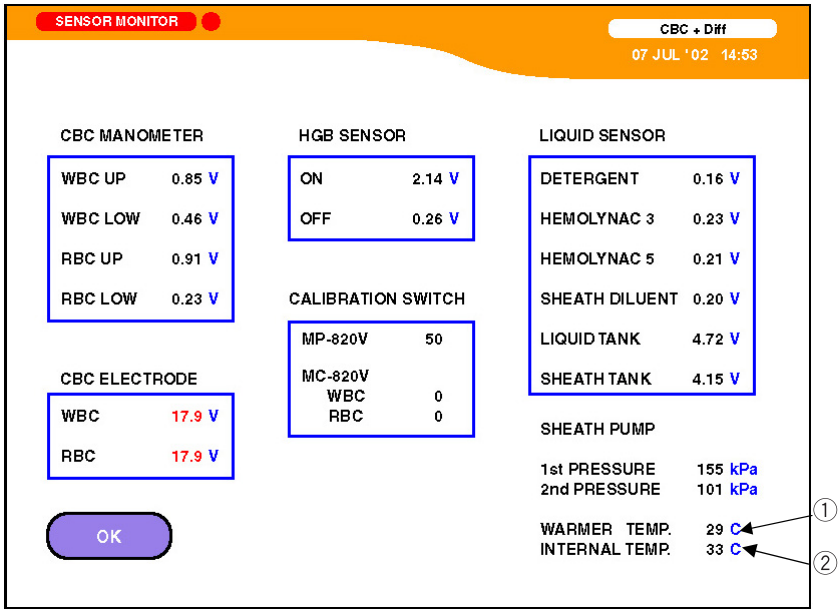
① 1st PRESSURE: Pressure detected by the first pressure sensor on the UT-7158 SHEATH CONTROL board in the MP-822V sheath pump unit.
② 2nd PRESSURE: Pressure detected by the second pressure sensor on the SHEATH CONTROL board in the sheath pump unit.



The normal range of the first pressure sensor: 130 to 160 kPa
The normal range of the second pressure sensor: 80 to 120 kPa

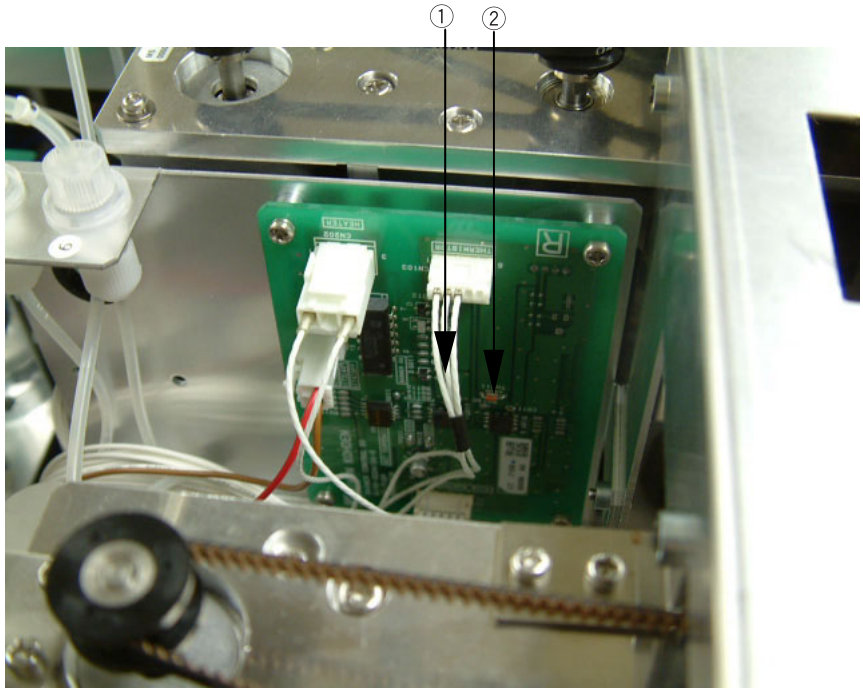
Temperature Sensor

The temperature values from the temperature sensors in the ZY-820V warmer unit are displayed.



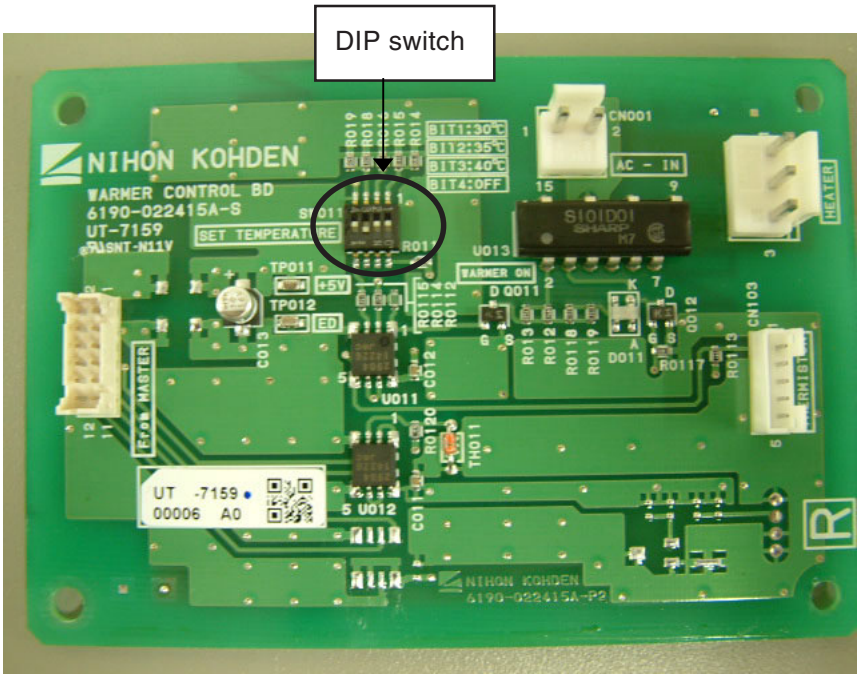
① WARMER TEMP: Temperature detected by the temperature sensor on the heater of the warmer unit.

② INTERNAL TEMP: Temperature detected by the temperature sensor on the WARMER CONTROL board in the warmer unit.



Setting on the UT-7159 WARMER CONTROL board

The WARMER CONTROL board controls the heater by turning it on or off according to the temperature set by resistance of the thermistor.
The temperature can be set to 30°C, 35°C, 40°C or OFF by the DIP switch setting as shown below.



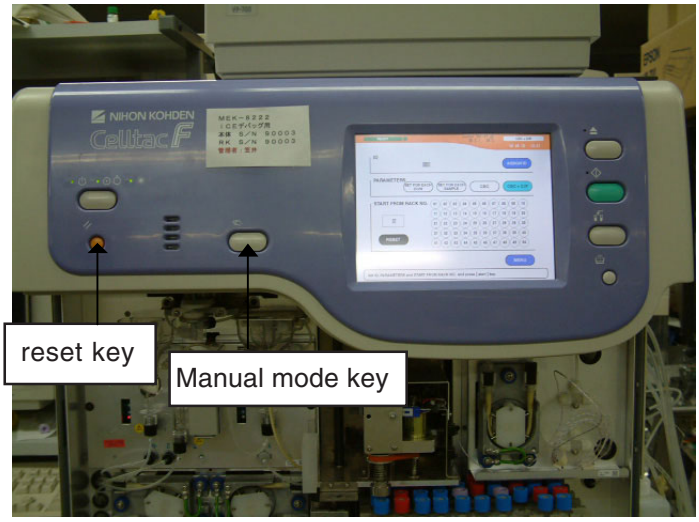
DIP switch setting

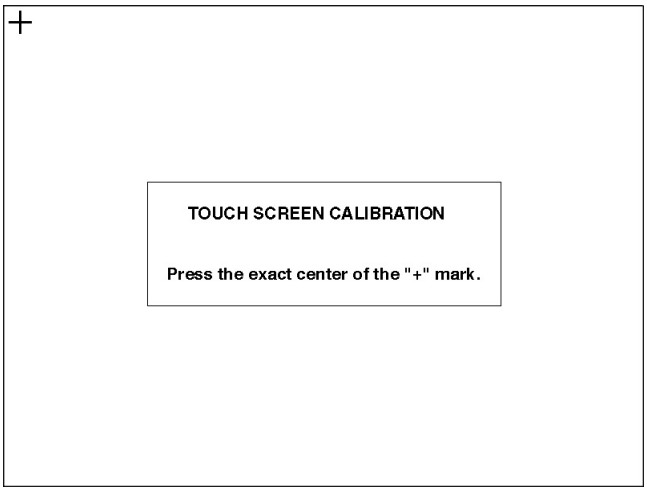
Set Temperature	BIT 1	BIT 2	BIT 3	BIT 4
30°C	ON	OFF	OFF	OFF
35°C	OFF	ON	OFF	OFF
40°C	OFF	OFF	ON	OFF
Heater OFF	OFF	OFF	OFF	ON

The DIP switch is set to 40°C at the factory.

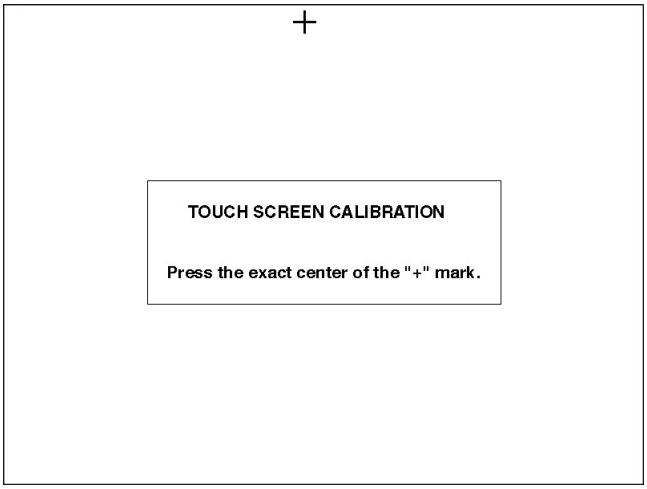
Calibrating the Touch Screen

1. Press the Manual mode key while pressing the reset key.
   The TOUCH SCREEN CALIBRATION screen appears.





2. Touch the cross-point of the + mark at the upper left corner of the LCD. Immediately after touching the touch point, the instrument generates a pip tone and the + mark moves to the upper center point of the LCD.



3. Touch the cross-point of the + mark of the LCD whenever the mark moves to a different position.

4. In the last touch the cross-point of the + mark at the lower right corner of the LCD. The screen changes to the READY screen which shows you that the touch screen calibration is completed.